STATED MEETING, September 12.

President Bland in the Chair.

On report of the respective Committees, the following Papers were ordered to be published.

ON CERTAIN ENTOMOLOGICAL SPECULATIONS OF THE NEW ENGLAND SCHOOL OF NATURALISTS.

BY BENJ. D. WALSH, M. A.

I. In Prof. Agassiz's Book on Lake Superior, he asserts in the most unqualified manner that the Insects of the temperate zone of North America "differ specifically throughout" from those of Europe. And subsequently he remarks that "quite a number of European insects have been introduced into this country along with plants, among which may be mentioned some showy butterflies, as *Vanessa Atalanta*, *cardui* and *Antiopa*, which are very erroneously considered by some entomologists as native Americans." (Pp. 187, 190.)

This assertion is the more startling, because he himself catalogues in the same work a very great number of plants as common to the temperate zones of North America and Europe, some of which he considers as introduced, while at the same time he distinctly states that he does not intend to deny the fact of others being indigenous both in North America and in Europe, (*ibid* p. 187); and because the very same work that contains the above remarks contains also a list of Coleoptera by Dr. LeConte, in which several species are enumerated as in his opinion common to both Continents,* and at the conclusion of which it is expressly asserted by that author, that there are certain rare cases in which "the same species, or organic forms so similar as to present

---

* E. g. *Bembidium 4-maculatum* Lin., *Upis ceramboides* Fabr., *Hippodamia 13-punctata* Lin., and *Coccinella 15-punctata* Oliv.

no appreciable difference, appear at points so situated as to preclude the possibility of any intercommunication." (*Ibid.* pp. 201—239 and p. 239.)

Since, 1*stly*, it is not denied even by Prof. Agassiz himself, that many plants which cannot be supposed to have been introduced are common to the two continents; since, 2*ndly*, several birds, which cannot be reasonably supposed to have been introduced, for example the common mallard, the blue-winged teal and the magpie, are common to both continents; and since, *lastly*, there is a mammal—*Homo sapiens* Lin.—common to both continents, though the American variety differs so remarkably from the European one, that if an American insect differed as much from a European one it would undoubtedly be considered as a distinct species;—for these three reasons, arguing *a priori*, it might be reasonably inferred that out of the vast multitude of insects there would be at least a few species indigenous on both sides of the Atlantic. Yet, owing to the preponderant influence exerted for many years back over American naturalists by Prof. Agassiz, most entomologists in this country have hitherto either tacitly acquiesced in his theories or become devoted believers in them. Hence the American describers of new species of insects have generally been content with ascertaining, that a species supposed to be new had not been hitherto described as American, and have troubled their heads but little as to whether the same species might not have been described as exotic. Had it been otherwise, many more species would probably have been found to be common to the New and Old Worlds than it is possible now to point out. Latterly, however, in two Orders*—Neuroptera and Diptera—the

---

*I use the term *Orders* here and throughout in the ordinary sense of the term. Agassiz considers Insects, Crustaceans and Worms as the three *Classes* of Annulata, and Insects he subdivides into three *Orders*—Winged Insects, Arachnida (Spiders, &c.) and Myriapoda (Centipedes, &c.). What are usually called Orders by Entomologists, are apparently degraded by him into *Suborders*. Dr. LeConte calls the *Orders* of Agassiz *Subclasses*, and uses the term *Orders* in its ordinary sense. Prof. Dana uses the terms *Class* and *Order* in the same sense as Agassiz, and calls Hymenoptera, Diptera, &c. *tribes*, introducing between the *Order* and the *Tribe* certain divisions which he denominates *suborders* and *ordinules*. "Nominum hæc continua subversio," says Latreille, speaking of the continual substitution of one generic name for another, "scientiam occidit." (Gen. Cr. et Ins. iv. p. 19.)

American fauna has been subjected to a searching comparison with that of Europe and other countries by two distinguished European naturalists, Dr. Hagen and Mr. Loew. In the former order it results from Dr. Hagen's investigations, that out of 716 North American species no less than 16, or 2.23 per cent, are undoubtedly common to Europe and North America, to say nothing of several species of doubtful identity, and of 14 North American species which occur also in Asia, Africa or Polynesia.* In the latter Order, Diptera, it results from Mr. Loew's investigations that, out of 2058† North American species or thereabouts, the extraordinary number of 91 species, or 4.42 per cent, are ascertained with certainty to be common to Europe and North America, and there are many others which, although they differ slightly in the two countries, are believed by Loew to be of the same descent.‡

But, some will say, all these species may have been introduced into one or the other country, and not be indigenous in both. Mr. Loew investigates this question in the case of Diptera at considerable length, comparing the intermingling of different faunas on the shores of the Mediterranean, where commercial intercourse has been carried on for time immemorial, and not merely for a few centuries, and where the voyages are comparatively brief; and finally decides that it is "utterly improbable that all the species, now occurring on both continents, should have been gradually carried over from one to the other." In the case of the Pseudoneuropterous Dragon-flies, no less than nine species of which occur both in the New and in the Old World, it is altogether out of the question, in view of the well known difficulty of breeding these insects in confinement, that they could have been introduced from one country to the other by human agency.

A strenuous disciple of Prof. Agassiz observes to me, that "the most that can be said of those species which are asserted to be common to

---

* Hagen's *Synopsis N. A. Neur.* p. 332.

† Osten Sacken's Catalogue of described N. A. Diptera, contains 2058 species. Very many of these are professedly mere synonyms; but on the other hand many new species have been described since that Catalogue appeared (A. D. 1858,) and several undescribed species are taken into the account by Loew.

‡ *Diptera of the Amber-fauna*, by Director Loew; translated in *Silliman's Journal*, May, 1864, by Baron Osten Sacken.

both continents is, that no distinctions have yet been discovered on careful study." At this rate, if I choose to assert that the Insects of Illinois differ specifically throughout from those of the other States, I may successfully defend that absurd hypothesis against the whole world by the same curious method of argumentation. Surely the large percentage of forms asserted on the very best authority to be identical, cuts the ground away from under such reasoning as this. Suppose, which is scarcely a supposable case, that it is only an even chance that Loew is right, in deciding that the Dipterous North American form A_1 is identical with the European form E_1; then the chance of his being mistaken in this particular instance will be $\frac{1}{2}$, and the *compound* chance of his being mistaken in *every one* of n similar cases, as to species A_2 and E_2, A_3 and E_3, ... A_n and E_n, will be $\frac{1}{2^n}$, which when n is large becomes so exceedingly small that it is scarcely worth taking into account. But in this case n is exceedingly large and consequently $\frac{1}{2^n}$ almost inconceivably small, so that the chance of Loew being mistaken *throughout* amounts almost, according to the Theory of Chances, to a negative certainty.* Or are facts and figures to go for nothing, and are we to form our theories first, and afterwards ignore or deny all facts and all reasonings that run counter to those theories?

In order to throw further light upon this question, I have prepared, from the very limited resources at my disposal, the following imperfect list of species in all the Orders, which are asserted by authors to be found both in North America and in the Old World. I have followed Loew's example in including in the list all species common to both countries, even those which I believe myself to have been introduced, because to attempt to draw any line between introduced and indigenous species would be begging the question at issue. The authority

* Assuming the chance of Loew's being mistaken in a single average case to be as large as it may seem proper, say $\frac{p-1}{p}$ taking p pretty large, yet when n is so exceedingly large as it is here, the chance of his being mistaken *throughout*, or $(\frac{p-1}{p})^n$, will always be a very small quantity indeed.

in the case of each species is printed in *italics*. The general results may be thus tabulated :—

	Identical Species.	*Species closely allied or of doubtful identity.*	*Total.*
Coleoptera	50	11	61
Orthoptera	1	0	1
Pseudoneuroptera	10	10	20
Neuroptera	9	2	11
Hymenoptera	5	4	9
Lepidoptera	57	6	63
Homoptera	2	1	3
Heteroptera	5	2	7
Diptera	165	20	185
	Total...304	56	360

Species of Insects common to North America and the Old World.

COLEOPTERA.—Identical species.

Carabidæ. Amara vulgaris (Eur. and Boreal America) *Kirby.*—A. communis (Eur. and U. S.) *Dejean.*—A. familiaris (Eur. and U. S.) *Dejean.*—A. similata (Eur. and U. S.) *Dejean.*—Curtonotus convexiusculus (Eur. and Bor. Am.) *Kirby.*—Pterostichus orinomum (Eur. and N. A.) *Kirby* and *Klug.*—Bembidium oppositum Say and B. 4-maculatum (Eur.) *LeConte.*—B. tetracolum Say and B. rupestre (Eur.) *LeConte.*—**Gyrinidæ.** Gyrinus æneus (Eur. and Bor. Am.) *Kirby.*—**Hydrophilidæ.** Philhydrus marginellus (Eur. and Bor. Amer.) *Kirby.*—Ph. melanocephalus (Eur. and Bor. Am.) *Kirby.*—Hydrobius fuscipes (Eur. and Bor. Am.) *Kirby.*—Cercyon mundum Melsh. and C. centrimaculatum (Eur.) *LeConte* and *Erichson.*—C. maculatum Melsh. and C. anale (Eur.) *LeConte* and *Erichson.*—**Silphidæ.** Silpha caudata Say and S. lapponica (Eur.) *LeConte.*—**Staphylinidæ.** Tachinus trimaculatus Say and Bolitobius pygmæus (Eur.) *Erichson.*—Tachyporus faber Say and T. brunneus (Eur.) *Erichs.*—Oxytelus rugulosus Say and O. nitidulus (Eur.) *Erichs.*—Olisthærus laticeps Lec. and O. megacephalus (Eur.) *LeConte.*—**Phalacridæ.** Olibrus bicolor (Eur. and U. S.) *LeConte.*—**Cucujidæ.** Silvanus dentatus Say and Nausibius dentatus (Eur.) *LeConte.*—**Mycetophagidæ.** Typhœa fumata (Eur. and all parts of the world) *LeConte.*—**Dermestidæ.** Dermestes lardarius (Eur. and N. A.) *Melsheimer,* &c.*—Attagenus cylindricornis Say and A. megatoma (Eur.) *LeConte.*—**Byrrhidæ.** Byrrhus alternatus Say and Cytilus varius (Eur.) *LeConte.* **Scarabæidæ.** Onthophagus rhinocerus Melsh. and O. xiphias (Eur.) *Melsheimer.*—Aphodius nodifrons Rand. and A. fimetarius (Eur.) *LeConte.*—A. 4-tuberculatus Fabr. and A. granarius (Eur.) *LeConte.*—A. pensvallensis Melsh. and A. errati-

* As I have already said, (*Proc. Ent. Soc. Phil.* II. p. 184,) I find this species abundant in the woods of Illinois remote from houses, and incline to believe that it is indigenous.

cus (Eur.) *Melsh.*—Cetonia vestita Say and C. hirta (Eur.) *Schaum and others.*—**Buprestidæ.** Melanophila longipes Say and M. appendiculata (Eur.) *Kirby and others.*—**Ptinidæ.** Rhizopertha pusilla (Eur. and N. A.) *LeConte.*—**Tenebrionidæ.** Tenebrio reticulatus Say (Can. Me. and Lake Sup.) and Upis ceramboides (Eur.) *LeConte.*—T. molitor (Eur. and N. A.) *Melsh.* &c.—**Melandryidæ.** Xylita buprestoides Payk. (Eur. and Bor. Am.) *Kirby.*—**Œdemeridæ.** Œdemera apicalis Say and Nacerdes melanura (Eur.) *LeConte.*—**Curculionidæ.** Sitophilus granarius (Eur. and N. A.) *Harris.* Sitophilus remotepunctatus (Europe and North Amer.) *Harris.*—**Cerambycidæ.** Callidium antennatum Newm. and C. violaceum (Eur.) *Harris.*—**Crioceridæ.** Crioceris asparagi (Eur. and N. A.) *Fitch.*—**Galerucidæ.** Galeruca sagittariæ Gyllenh. (Eur. and N. A.) *Kirby.*—G calmariensis (Eur. and N. A.) *Melsh.* &c.—**Chrysomelidæ** Eumolpus cochlearius Say and Adoxus (bromius) vitis (Eur.) *Kirby.*—Chrysomela cæruleipennis Say and C. polygoni (Eur.) *LeConte.*—C. lapponica Lin. (Eur. and Bor. Am.) *Mannerheim.*—Phyllodecta vitellinæ (Eur. and N. A.) *Kirby.*—Ph. rufipes (Eur. and N. A.) *Kirby.*—**Coccinellidæ.** Coccinella mali Say and Myzia 15-punctata (Eur.) *LeConte.*—C. tibialis Say and Hippodamia 13-punctata (Eur.) *LeConte.*—C. bioculata Say and C. bipunctata (Eur.) *Mulsant.*—In all 50 species.

COLEOPTERA.—Species closely allied or of doubtful identity.

Carabidæ. Elaphrus ruscarius Say and E. riparius (Eur.) very near. *Say.*—Notiophilus semistriatus Say and N. aquaticus (Eur.) possibly the same. *Dejean.*—Diachila subpolaris Lec. (Bor. Am.) and D. arctica (Eur.) allied. *LeConte.*—**Dytiscidæ.** Hydroporus dubius Melsh. and H. dorsalis (Eur.) *Melsh.*—**Staphylinidæ.** Staphylinus dimidiatus Say and Philonthus ventralis (Eur.) probably the same. *Leconte.*—Acidota seriata Lec. and A. crenata (Eur.) descriptions agree. *LeConte.*—**Nitidulidæ.** Nitidula undulata Say and N. varia (Eur.) analogous. *Say.*—**Dermestidæ.** Dermestes nubilus Say and D. murinus (Eur.) very near. *Say* and *LeConte.*—**Tenebrionidæ.** Boros unicolor Say and B. elongatus (Eur.) very near. *Say* and *LeConte.*—**Curculionidæ.** Dryophthorus corticalis Say and D. lymexylon (Eur.) very near. *Say.*—**Coccinellidæ.** Chilocorus bivulnerus Muls. (=stigma *Say*) and C. renipustulatus (Eur.) very near. *Kalm* and *Say.*—In all 11 species.

ORTHOPTERA.—Identical species.

Blatta orientalis* (Asia, Eur., Atlantic seaboard of U. S.) *Harris, Scudder.*

PSEUDONEUROPTERA.—Identical species.

Termitina. Termes flavipes Köll. (Hot-houses Germ. and N. A.) *Hagen.*—

* I found a single ♀ of what is probably this species under bark nearly a mile from any houses near the little inland village of Jonesboro in South Illinois. So far as I am aware, it does not occur anywhere in Illinois in houses. Perhaps commerce may have introduced it at St. Louis, and it may have spread thence into South Illinois. In North Illinois it does not occur at all, so far as I know, though we have two species of Blattidæ there belonging to Mr. Scudder's new genus Platamodes, and another which apparently must form a new genus.

Agrionina. Calopteryx splendens Selys. (Eur., N. Asia and Georgia ?) *Hagen.*—**Æschnina.** Anax Junius Drury (N. A. everywhere and Asia) *Hagen.*—Æschna juncea Lin. (Russ. Am., Eur. and Asia) *Hagen.*—Æ. grandis Lin. (New Jersey, Eur., Asia) *Hagen.*—**Libellulina.** Pantala flavescens Fabr. (N. and S. Am., Asia, Oceanica, Africa. Eur.?) *Hagen.*—Tramea chinensis DeG. (Carolina, Virginia and Asia) *Hagen.*—Libellula 4-maculata Lin. (Can., Wisc., Mass., Illin., Eur., Asia) *Hagen.*—Mesothemis corrupta Hag. (Tex., Illin. and Asia) *Hagen.*—Diplax scotica Don. (North Red Riv. N. A., Eur., Asia) *Hagen.*—In all 10 species.

PSEUDONEUROPTERA.—Species closely allied or of doubtful identity.

Psocina. Psocus salicis Fitch = geologus Walsh (N. Y., Ill.) and Ps. pedicularius (Eur.) *Hagen.*—**Ephemerina.** Cloe bioculata (N. Y., Hudson's Bay Terr. and Eur.) *Walker & Hagen*—Cl. diminuta Walk. (Florida) and Cl. lactea (Eur.) allied. *Hagen.*—**Agrionina.** Lestes forcipata Hag. Synops. = hamata Monogr. Agr. (Wisc., D. C. and Illin.) and L. nympha (Eur.) hardly different. *Hagen.*—Agrion annexum Hag. and A. cyathigerum (Eur.) allied. *Hagen.*—**Æschnina.** Ophiogomphus colubrinus Selys (H. B. T.) and O. serpentinus (Eur.) very much alike. *Hagen.*—Cordulegaster Sayi Selys (Georgia) and C. annulatus (Eur.) similar. *Hagen.*—Æschna sitchensis Hag. (Russ. Am.) and Æ. borealis (N. Eur. and Siberia) very much alike. *Hagen.*—**Libellulina.** Libellula julia Uhler (Wisc., Wash. T.) and L. fulva (Eur.) analogous species. *Hagen.*—Diplax (rubicundula Say =) assimilata Uhl. (U. S.) and D. flaveola (Eur.) very much alike. *Hagen.*—In all 10 species.

NEUROPTERA.—Identical species.

Sialina. Rhaphidia media Burm. (Eur. and N. A.) *Hagen.*—**Hemerobina.** Chrysopa flava Scop. (Penna., Eur., Asia.) *Hagen.*—**Phryganeina.** Limnophilus rhombicus Lin. (H. B. T., Greenland, Eur., Asia.) *Hagen.*—L. interrogationis Zett. (Greenland, Lapland, Eur.) *Hagen.*—L. subpunctulatus Zett. (Bor. Am. and Eur.) *Hagen.*—L. trimaculatus Zett. (Bor. Am. and Eur.) *Hagen.*—L. griseus Lin. (Greenland, Eur., Asia.) *Hagen.*—Leptocerus niger Lin. (D. C. and Eur.) *Hagen.*—Setodes ochracea Curt. (Georgia and Eur.) *Hagen.*—In all 9 species.

NEUROPTERA.—Species closely allied or of doubtful identity.

Phryganeina. Phryganea commixta Walk. (Georgia) and P. minor (Eur.) allied. *Hagen.*—Colpotaulius perpusillus Walk. (H. B. T.) and C. incisus (Eur.) very closely allied. *Hagen.*—In all 2 species.

HYMENOPTERA.—Identical species.

Tenthredinidæ. Cimbex 10-maculata Leach (Canada and Eur.) *D'Urban.*—**Uroceridæ.** Sirex bizonatus Steph. (Can. and Eur.) *Kirby.*—S. juvencus Lin. (Bor. Am. and Eur.) *Kirby.*—**Vespidæ.** Vespa vulgaris Lin. (N. A. and Eur.) *Saussure* and *Norton* MS.—**Apidæ.** Apis mellifica Linn. (N. A. and Eur.) *St. Fargeau*, &c.—In all 5 species.

HYMENOPTERA.—Species closely allied or of doubtful identity.

Tenthredinidæ. Zarea inflata Nort. and Z. fasciata (Eur.) *Norton.*—Nematus

monochroma Nort. and N. luteus (Eur.) *Norton.*—N. proximatus Norton and N. proximus (Eur.) *Norton.*—N. luteotergum Nort. and N. dimidiatus (Eur.) *Norton.*—In all 4 species.

LEPIDOPTERA.—Identical species.

Papilionidæ. Papilio zolicaon Luc. (Calif.) and P. Machaon (H. B. Terr. and Eur.) *Menétries.*—**Pieridæ.** Colias Edusa (Four quarters of the globe.) *Boisd.**—C. Chrysotheme (N. A. and Eur.) *Boisd.*†—C. Hyale (Califor., Eur., Africa) *Boisd.*†—Pieris Callidice Godt. (Rocky Ms. and Eur.) *Doubleday.*—P. Leucodice Eversm. (Siber. and Cal.) *Boisduval.*—Anthocaris ausonia Hubn. (Calif. and Eur.) *Hübn.*—Rhodocera rhamni Lin. (Calif., Eur.) *Boisduval.*—**Nymphalidæ.** Argynnis Aglaia Lin. (Calif., Rocky Ms., Eur.) *Godart* and *Edwards.*—Grapta Faunus Edwards (N. Y. and Penna.) and G. C-album (Eur.) *Boisd. & Lec.*.—Vanessa Antiopa Lin. (U. S. and Eur.) *Harris*, &c.—Pyrameis Atalanta Lin. (U. S. and Eur.) *Harris*, &c.—P. cardui Lin. (4 quarters of the globe) *Morris*, &c.—**Satyridæ.** Chionobas balder Boisd. and Lec. (North Cape, Greenland, Labr.) *Boisd.*—Ch. bootes Bdv. and Lec. (North Cape, Greenland, Labr.) *Boisd.*—Ch. œno Bdv. (Lapland, Siberia, Labr.) *Boisd.*—**Lycænidæ.** Lycæna americana Harr. and L. phlœas (Eur.) *Boisd.*—**Hesperidæ.** Hesperia silvanus Bdv. (Calif. and Eur.) *Boisd.*—H. comma Lin. (Calif. and Eur.) *Boisd.*—**Sphingidæ.** Trochilium tipuliforme Lin. (Eur. and U. S.) *Harris* and *Fitch.*—Deilephila chamænerii Harr. (U. S.) and D. galii (Eur.) *Walker.*—**Arctiadæ.** Orgyia antiqua (Eur. and U. S.) *Harris.*—**Noctuadæ.** Leucania straminea Treitsch. (N. Y. and Eur.) *Guén.* and *Cat. Brit. Museum.*—L. pallens Lin. (U. S. and Eur.) *Morris* MS.—L. unipuncta Haw. (army-worm moth) = extranea Guén. (Eur. and U. S.) *Guén.* and *Stainton's Entom. Annual.*—Scolioptery x libatrix Lin. (Eur. and U. S.) *Guén.* and *Cat. B. M.*)—Nænia typica Doubled. (Eur. and U. S.) *Cat. B. M.*—Plusia festucæ Albin. (Eur. and N. A.) *Guén. C. B. M.*—Pl. Mya Hübn. (Eur., Can.) *Guén. C. B. M.*—Euplexia lucipara Lin. (N. Y., Eur.) *Guén. C. B. M.*—Eurois herbida Den. and Schieff. (N. A., Eur.) *Guén. C. B. M.*—E. occulta Guén. (Can. and Eur.) *Guén. C. B. M.*—Hadena W-latinum Guén. (N. A., Eur.) *Guén. C. B. M.*—H. pisi Lin. (N. A., Eur.) *Guén. C. B. M.*—H. rectilinea Esper. (N. A., Eur.) *Guén. C. B. M.*—H. amputatrix Fitch and H. amica (Eur. and U. S.) *Fitch* and *Stephens.*—Graphiphora C-nigrum auct. (U. S. and Eur.) *Guén. C. B. M.*—G. triangulum Guén. (N. Y. and Eur.) *Guén. C. B. M.*—G. Dahlii (U. S. and Eur.) *Guén. C. B. M.*—G. augur Fabr. (U. S. and Eur.) *Guén. C. B. M.*—G. baja Gmel. (N. Y. and Eur.) *Guén. C. B. M.*—Orthosia instabilis Schifferrmyller (New York and Europe) *Fitch.*—Cucullia chamomillæ Fab. (N. Y. and Eur.) *Guén. C. B. M.*—Agrotis suffusa Den. and Sch. (U. States,

* Messrs. Edwards and Scudder consider that the species which has been taken for Edusa in the United States is C. Eurytheme Boisd. = C. Amphidusa Boisd. (Calif. and Western States.)

† Mr. Scudder considers that the species mistaken for Hyale in California is the pale ♀ of Eurytheme, and also, if I understand him aright, that the species mistaken for Chrysotheme is the common Philodice.

Eur., Asia) *Guén. C. B. M.*—A. ravida Den. and Sch. (U. S. and Eur.) *Guén.*—A. subgothica (U. S. and Eur.) *Fitch.*—Chersotis plecta Lin. (N. Y. and Eur.) *Grote.*—Dipterygia pinastri Lin. (U. S. and Eur.) *Grote.*—Heliothis umbrosa Grote and H. armigera Lin. (U. S. and Eur.) *Grote.*—**Pyralidæ.** Aglossa cuprealis Hübn. (U. S. and Eur.) *Guén. C. B. M.*—**Microlepidoptera.** Carpocapsa pometella (U. S. and Eur.) *Fitch*, &c.—Tinea lanariella Clemens and T. biselliella (Eur.) *Stainton.*—T. nubilipennella Clem. and T. fuscipunctella (Eur.) *Stainton.*—Plutella vigilaciella Clem. and P. porrectella (Eur.) *Stainton.*—Pl. limbipennella Clem. and Pl. cruciferarum (cosmopolitan) *Stainton.*—Nepticula rubifoliella Clem. and N. angulifasciella (Eur.) *Clemens.*—Gelechia cerealella Oliv. (U. S. and Eur.) *Harris* and *Clemens.*—In all 57 species.

LEPIDOPTERA.—Species closely allied or of doubtful identity.

Noctuadæ. Catocala Walshii Edwards (South Illin.) and C. elocata (Eur.) *Edwards.*—Plusia alticola Walker (=ignea Grote) and P. divergens (Eur.) *Grote.*—**Microlepidoptera.** Loxotænia rosaceana Harr. and L. rosana (Eur.) doubtful if different. *Fitch.*—Tinea biflavimaculella Clem. and T. spilotella (Eur.) *Stainton.*—Argyresthia oreasella Clem. and A. andereggiella (Eur.) *Stainton.*—Bedellia staintoniella Clem. and B. somnulentella (Eur.) *Stainton.*—In all 6 species.

HOMOPTERA.—Identical species.

Aphidæ. Aphis mali (N. A. and Eur.) *Fitch.*—**Coccidæ.** Aspidiotus conchiformis (N. A. and Eur.) *Fitch.*—In all 2 species.

HOMOPTERA.—Species closely allied or or doubtful identity.

Cercopidæ. Ledra aurita (Illin. and Eur.) *Walsh* MS.

HETEROPTERA.—Identical species.

Coreidæ. Xylocoris domesticus Hahn (N. A. and Eur.) *Fitch.*—**Lygæidæ.** Lygæus geminatus Say and Cymus resedæ (Eur.) *Uhler.*—**Cimicidæ.** Cimex lectularius (N. A. and Eur.) *Fitch.*—**Hydrometridæ.** Gerris paludum (Eur. and N. A.) *Uhler* MS.—Gerris lacustris (Eur. and N. A.) *Uhler* MS.—Dr. Fitch states generally of this Order that very many American species are certainly identical with those of Europe. (N. Y. Rep. I. p. 295.)—In all 5 species.

HETEROPTERA.—Species closely allied or of doubtful identity.

Lygæidæ. Lygæus eurinus Say and Alydus calcaratus (Eur.) *Uhler.*—**Nepidæ.** Ranatra fusca Beauv. (Illin.) and R. linearis (Eur.) *Walsh* MS.—In all 2 species.

DIPTERA.—Species common to N. A. and Europe, named with certainty and from personal investigation by Loew.*

Anopheles maculipennis Meig.—A. quadrimaculatus Say = pictus Loew.—A. nigripes Stæg.—Tanypus choreus Meig.—Ceratopogon lineatus Meig.—

* The first three lists of Diptera are copied verbatim from those appended by Loew himself to the translation of his Paper on the "Diptera of the Amber-fauna" by Baron Osten Sacken. (*Sill. Journ.* May, 1864, pp. 317—319.) Consequently, except for three species enclosed in brackets at the end of the first list, Loew is here the authority throughout.

Cecidomyia destructor Say = funesta Motch. = secalina Lw.—Scatopse atrata Say = recurva Lw.—Scatopse notata Linn.—Aspistes borealis Lw.—Rhyphus fenestralis Scop. — R. punctatus Meig. = marginatus Say.—Cœnomyia ferruginea Fabr. = pallida Say.—Sargus viridis Say = frontalis Lw., provided the specimen, communicated to me as European, really belonged to the Old World.—Eristalis æneus Scop. = sincerus Harris.—Imatisma posticata Fabr. = cimbiciformis Fall.—Syritta pipiens Linn.—Xylota pigra Fabr. = hæmatodes Fabr.—Platychirus granditarsus Först.—Brachyopa ferruginea Fall.—Scenopinus fenestralis Linn. = pallipes Say.—Sc. lævifrons Meig.—Dolichopus brevipennis Meig.—Dol. plumipes Scop.—Dol. discifer Stann.—Scellus spinimanus Zett.—Psilopus pallens Wied. = albonotatus Lw.—Œstrus bovis Fabr.—Cephalomyia ovis Linn.—Gastrus equi Linn.—Melanophora roralis Linn.—Pollenia rudis Fabr.—Musca domestica Linn.—Cyrtoneura meditabunda Fabr. —C. stabulans Fall.—Mesembrina resplendens.—Stomoxys calcitrans Linn.—Anthomyia diaphana Wied.—A. stygia Meig.—Aricia morioides Zett.—Hylemyia angelicæ Scop.—Hydrotæa dentipes—Hylemyia urbana Meig.—Homalomyia canicularis Linn.—H. subpellucens Zett.—H. manicata—H. scalaris Fabr.—Hydrotæa armipes Fall.—Ophyra leucostoma Wied.—Lispe uliginosa Fall.—Scatophaga squalida = S. furcata Say?—S. stercorea Linn.—Cordylura hircus.—Sapromyza lupulina Fabr.—Scyphella flava Linn.—Lauxania cylindricornis Fabr.—L. frontalis Lw.—Psila bicolor—Sciomyza nana Fall.—S. obtusa Fall.—S. albocostata Fall.—Dryomyza anilis Fall.—Blepharoptera iners —Ortalis vibrans Linn.—O. cana Lw.—Piophila casei Linn.—P. nigriceps Meig.—P. petasionis R. Desv.—Heteroneura albimana—Borborus equinus Fall. —Drosophila ampelophila Lw.—D. transversa.—D. graminum.—Stegana nigra Meig.—S. hypoleuca Meig.—Dichæta caudata Fall.—D. brevicauda Lw.—Scatella quadrata Fall.—Sc. Stenhammari Zett.—Ochthera mantis DeG.—Ilythea spilota Hal.—Melophagus ovinus Linn.—Olfersia ardeæ Macq.—Hippobosca equina Linn.

Besides a great many other species, the occurrence of which on both continents is recorded with less certainty, the following European species are found in Greenland, according to Stæger's trustworthy statements:—Diamesa Waltlii Meig.—Chironomus byssinus Meig.—C. aterrimus Meig.—C. picipes Meig.—Trichocera maculipennis Meig.—Sciara flavipes Meig.—Calliphora erythrocephala Meig.—Phytomyza obscurella Fall.

[Rhipidia maculata Meig. and Symplecta punctipennis Meig. may be also added with certainty.—*O. Sacken.* Also, according to Osten Sacken apud *Say's Works* I. p. 243, Limnobia annulata Linn. = argus Say = imperialis Lw.—*B. D. W.*]—In all 94 species.

DIPTERA.—Species believed to be of the same descent but distinguishable from European species by a slight, but constant, difference of coloring.

Subula pallipes Lw. (N. A.) and S. marginata Meig. (Eur.)—Chrysotoxum sp. indescr. and C. bicinctum Linn.—Tetanocera pictipes Lw. and T. umbrarum Linn.—T. saratogensis Fitch and T. pratorum Fall.—Hemerodromia valida Lw. and H. Frigelii Zett. and a large number of others.—In all 5 species.

DIPTERA.—Species believed to be of the same descent but distinguishable. in addition to the above, by very insignificant plastic discrepancies.

Bombylius fraterculus Wied. and B. major Linn. (Eur.)—Chrysotoxum sp. indescr. and C. fasciolatum DeG.—Helophilus sp. indescr. and H. frutetorum Fabr.—Lucilia sp. indescr. and L. cæsarion Meig.—Cyrtoneura sp. indescr. and C. assimilis Fall —Gymnosoma par Walk. and G. rotundata Linn.—Cordylura sp. indescr. and C. pudica Meig.—Allophyla lævis Lw. and A. nigricornis Meig.—Trypeta fratria Lw. and T. heraclei Linn.—Ortalis rufipes Lw. and O. marmorea Fabr.—Drosophila sp. indescr. and D. funebris—Ephydra atrovirens Lw. and E. micans Hal. and many other species.—In all 12 species.

DIPTERA.—Identical species, on various authorities.*

Tipulariæ. Culex caspius Pallas (South Russ. and Bor. Am.) *Curtis.*—Cecidomyia tritici (Eur. and U. S.) *Harris*, &c.—Limnophila fasciata Schummel (Eur. and N. A.) *Osten Sacken.*—Limnobia rivosa Lin. (Eur. and Greenl.) *O. Fabr.*—Trichocera regelationis Lin. (Eur. and Greenl.) *O. Fabr.*—Simulium reptans Lin. (Eur. and Greenl.) *O. Fabr.*—**Tabanidæ**. Chrysops sepulchralis Zett. (Eur. and H. B. T.) *Walker.*—**Asilidæ**. Dasypogon teutonus Lin. (Eur. and Flor.) *Macquart.*—Laphria flavescens Macq. (Eur. and Carolina.) *Macquart.*—**Bombyliarii**. Anthrax nycthomera Hoffm. (Eur. and Georg.) *Macquart.*—Bombylius major Lin. (Eur. and N. A.) *Walker.*†—**Empidæ**. Empis borealis Lin. (Eur. and Greenl.) *O. Fabr.*—Hemerodromia precatoria Meig. (Eur. and H. B. T.) *Walker.*—Drapetis nigra Meig. (Eur. and H. B. T.) *Walker.*—**Syrphici**. Chrysotoxum fasciolatum DeG. (Eur. and H. B. T.) *Walker.*‡—Syrphus gracilis Meig. (Eur. and N. Y.) *Walker.*—S. granditarsus Först. (Eur. and H. B. T.) *Walker.*—S. guttatus Meig. (Eur. and H. B. T.) *Walker.*—S. hieroglyphicus Meig. (Eur. and Nov. Sc.) *Walker.*—S. maculosus Meig. (Eur. and H. B. T.) *Walker.*—S. menthastri Lin. (Eur. and N. A.) *Walker.*—S. ribesii Fabr. (Eur. and Bor. Am.) *Walker.*—S. scalaris Fabr. (Eur. and U. S.) *Walker.*—S. scriptus Lin. (Eur. and Nov. Sc.) *Walker.*—S. topiarius Meig. (Eur. and N. A.) *Walker* and *Stæger.*—S. umbellatarum Fabr. (Eur. and N. Sc.) *Walker.*—Sericomyia lappona Lin. (Eur. and Greenl.) *O. Fabr.*—Helophilus grœnlandicus O. Fabr. (Lapl. and Greenl.) *O. Fabr.* and *Stæger.*—Volucella obesa Fabr. (S. A., N. A., Asia, Africa.) *Macquart*, &c.—V. plumata Fabr. (Eur. and Newfoundland.) *Macquart.*—**Œstracidæ**. Œstrus tarandi Lin. (Eur. and Bor. Am.) *Beauv.*—Gastrus hæmorrhoidalis Lin. (Eur. and New Eng.) *Harris.*—G. nasalis Lin. (Eur. and N. Y.) *Fitch.*—G. pecorum Fabr. (Eur. and Jamaica.) *Walker.*—**Muscidæ**. Gymnosoma rotundata Lin. (Eur. and Mass.) *Harris.*⁒—Tachina distincta R. D. (Eur. and Philad.) *Rob. Desv.*—Gonia auriceps Meig. (Eur., Georg. and Afr.) *Walker.*—Sarcophaga carnaria Lin. (Eur. and Mass.) *Harris.*—S. mortuarum Lin. (Eur. and Greenl.)

---

* A great many species included in Loew's first list had been previously recognized as identical by other authors, and are omitted here.

† Probably B. fraterculus Wied. in Loew's third list.

‡ Probably the *sp. indescr.* in Loew's third list.

⁒ Probably G. par Walk. in Loew's third list.

O. Fabr.—Musca cadaverina Lin. (Eur. and N. Y.) *Fitch.*—M. cæsar Lin. (Eur. and N. Y.) *Fitch* and *Walker.*—M. corvina Fabr. (Eur. and Nov. Sc.) *Walker.*—M. lepida R. D. (France and Philad.) *Rob. Desv.*—M. regina Meig. (Eur. and N. A.) *Harris.*—M. vespillo Fab. (Eur. and Nov. Sc.) *Walker.*—M. vomitoria Lin. (Eur and Mass.) *Harris.*—Anthomyia campestris R. D. (Eur. and N. A.) *Rob. Desv.*—A. ciliata Meig. (Eur. and Greenl.) *Stæger.*—A. irritans Meig. (Eur. and Greenl.) *Stæger.*—A. ruficeps Meig. (Eur. and Greenl.) *Stæger.*—A. saltatrix R. D. (Eur. and N. Am.) *Rob. Desv.*—A. striolata Meig. (Eur. and Greenl.) *Stæger.*—Cordylura hæmorrhoidalis Meig. (Eur. and Greenl.) *Stæger.*—C. pubera Lin. (Eur. and H. B. T.) *Walker.*—Scatophaga fucorum Meig. (Eur. and Bor. Am.) *Curtis.*—Sc. litorea Meig. (Eur. and Greenl.) *Stæger.*—Sc. scybalaria Lin. (Eur. and Greenl.) *O. Fabr.*—Ortalis cerasi Lin. (Eur. and Mass.) *Harris.*—Sepsis cylindrica Fabr. (Eur. and Mass.) *Harris.*—Lauxania Elisæ Weid. (Eur. and U. S.) *Walker.*—Lonchæa tarsata Fall. (Eur. and H. B. T.) *Walker.*—Calobata albimana Meig. (Asia and U. S.) *Macquart* and *Walker.**—Tetanocera elata Lin. (Eur. and Bor. Am.) *Walker.*—Heteromyza buccata Fall. (Eur. & N. Sc.) *Walker.*—Notiphila nitidula Fall. (Eur. and H. B. T.) *Walker.*—Ephydra stagnalis Meig. (Eur. and Greenl.) *Stæger.*—Drosophila cellaris Lin. (Eur. and N. Sc.) *Walker.*—D. funebris Meig. (Eur. and N. A.) *Macquart.*†—Phora aterrima Fabr. (Eur. and H. B. T.) *Walker.*—Ph. fuscipes Macq. (Eur. and H. B. T.) *Walker.*—Ph. rufipes Fabr. (Eur. and H. B. T.) *Walker.*—In all 71 species.

DIPTERA.—Species quoted as allied or of doubtful identity in Osten Sacken's Paper on Limnobina.

Limnobia (dicranomyia) morio Fabr. (Eur. and N. Y.)—Limnobia tristigma O. S. (Ill.) and L. tripunctata Meig. (Eur.)—Amalopis inconstans O. S. (U. S.) and Limnobia littoralis (Eur.)—Several N. A. sp. of Trichocera are also referred to (p. 242) as apparently identical with European species.—In all 3 species.

It will be seen from the above that no less than 36 authors—viz., placing them in alphabetical order, Beauvois, Boisduval, Clemens, Curtis, Dejean, Rob. Desvoidy, Doubleday, D'Urban, Edwards, Erichson, Otto Fabricius, Fitch, Godart, Grote, Guénee, Hagen, Harris, Hübner, Kirby, Klug, LeConte, Loew, Macquart, Mannerheim, Melsheimer, Menétries, Morris, Mulsant, Norton, Osten Sacken, Saussure, Schaum, Stæger, Stainton, Uhler and Walker—have testified to the existence in the Old and New Worlds of identical forms which cannot be supposed to have been introduced. Whether we decide by the number of the names, or by the great scientific weight of very many of them, the balance of authority is certainly against Prof. Agassiz.

---

* Can this be Heteroneura albimana (no author) of Loew's first list.?

† Probably the *sp. indescr.* in Loew's third list.

In some few of the above cases it is demonstrable that distinctions, such as are generally considered to be of specific value, exist between the forms found in the New and in the Old World. There can also be little doubt that some of the above species have been introduced into North America, but how many and which and where and when, it is generally impossible to say. In regard to the three butterflies asserted by Agassiz to have been introduced, it seems difficult to understand how *Vanessa Atalanta*, the larva of which feeds on the nettle, or *V. cardui*, the larva of which feeds on the thistle, could have been imported by human agency into North America. Do men import nettles and thistles? Even supposing that by some strange chance the eggs of these butterflies reached North America in a living state, by what unaccountable concatenation of events did it happen, that they were glued to a growing and living nettle or to a growing and living thistle? For every breeder of Lepidoptera knows, that it is necessary for the young larvæ to have at hand, immediately that they are hatched, a supply of their appropriate food, and that their senses do not enable them to discover that food, even if it lies only a few inches removed from them. Besides, in the case of *cardui*, it is necessary to account not only for its introduction by human agency into North America, but for its dispersion by the same agency nearly over the whole globe. As to *Antiopa*, the larva of which feeds on poplar-leaves, it may possibly have been introduced in the egg state along with young poplars; but there is a remarkable fact, not generally known, which makes against such a hypothesis. The chief foreign commerce of the United States even at the present day, and more especially so in former times, is and was with England. If imported at all, therefore, *Antiopa* was in all probability imported from England. Now British specimens of this butterfly belong to a distinct variety, with the border of the wings always white and not cream-colored; and specimens found in North America and on the Continent of Europe belong to another variety, with the border of the wings always cream-colored and not white. Whence it follows that, if imported at all, *Antiopa* in all probability must have been imported, not from England, but from the Continent of Europe, with which in colonial times this country held no commercial intercourse at all, and in later times comparatively but little.

If it had so happened that the variety of *Antiopa* with a white border to its wings was peculiar to North America, instead of being peculiar to England, how eagerly the fact would have been seized on by Prof. Agassiz and his school, as a proof that the supposed American variety was a distinct species! Truly says Loew, that forms which, if they had been found in Europe, would certainly have been considered as only slight varieties of other well-known European species, as their only deviation consists in a slight difference of coloring, when found in America are immediately pronounced to be distinct species. (*Amber-diptera*, p. 318.)

To investigate the probability or possibility of each particular insect, claimed to have been introduced into North America, having been in reality so introduced, would, however, be an endless task. It is sufficient to remark that if one single species, of the 304 asserted by various authors to be common to the New and Old Worlds, is indigenous in each of these two habitats, then, as a necessary consequence, the assertion of Prof. Agassiz, that our insect Fauna "differs specifically throughout" from that of Europe, falls to the ground.

It may be asked why Agassiz should have asserted so confidently that *all* the insects of the temperate zone of North America differ specifically from those of Europe. The answer is, that he believes in the theory of many contemporaneous local creations, or to use his own language, "that animals must have originated where they live, and have remained almost precisely within the same limits ever since they were created, except in a few cases, where, under the influence of man, those limits have been extended over large areas." (*Lake Superior*, p. 248.) Let us see where such a theory will lead us in the case of the geographical distribution of Coleoptera within the limits of the United States.

"The whole region of the United States," says Dr. LeConte, "is divided by meridional or nearly meridional lines into three, or perhaps four, great zoological districts, distinguished each by numerous peculiar genera and species, which, with few exceptions, do not extend into the contiguous districts. The Eastern one of these extends from the Atlantic Ocean to the arid prairies on the west of Iowa, Missouri and Arkansas. * * The Central District extends from the western limit of the Eastern District perhaps to the mass of the Sierra Nevada of Cali-

fornia; * * but it is very probable that this region does in reality constitute two districts bounded by the Rocky Mountains. The Western District is the maritime slope of the continent to the Pacific, and thus includes California, Oregon and Washington territories.

* * * * * *

"The method of distribution of species in the Atlantic and Pacific Districts, as already observed by me in various memoirs, is entirely different. In the Atlantic District a large number of species are distributed over a large extent of country; many species are of rare occurrence, and in passing over a distance of several hundred miles, but a small variation will be found in the species obtained. In the Pacific District, a small number of species are confined to a small region of country; most species occur in considerable numbers, and in travelling even one hundred miles, it is found that the most abundant species *are replaced by others, in many instances very similar to them.* * * In the Central District, consisting as it does to a very large extent of deserts, the distribution seems to be of a moderate number of species over a large extent of country, with a considerable admixture of local species." (LeC. *Col. Ks. and East. N. Mex.*, Oct. 1859, pp. iii—v.)

Assuming the correctness of these data and of the theory of Agassiz, it follows that there must have been at least three separate and distinct coleopterous creations within the limits of the United States. Nay, further. As on the Pacific slope, according to LeConte, every hundred miles that you travel you come upon a new coleopterous fauna, there must have been about twenty or thirty separate and distinct coleopterous creations there. For it is absurd to suppose that the Coleoptera, peculiar to each local district of 100 miles square, were formerly common to the whole territory and have all taken their origin from one common centre of creation. It would be as rational to believe, what Agassiz scouts as absurd, that all the faunas of the whole world were created simultaneously, with all their present specific and generic distinctions, in one common centre of creation, and thence spread themselves in locally distinct groups over the whole face of the globe, leaving no trace behind of the path travelled over by them in arriving at their present habitats.

When we take into account that the same reasoning which applies to North America applies also to other parts of the world, and that

almost every little oceanic island has its peculiar species of insects, if we accept Prof. Agassiz's theory we shall be compelled to believe, that there must have been many hundred or even thousand distinct Creations within the present geological era. It may possibly have been so: but views like these certainly do not harmonize with such demonstrable entomological facts, as the existence of identical indigenous species in faunas separated by a wide expanse of ocean, and they seem scarcely consistent with the grandeur and simplicity of Nature.

If, rejecting the Creative theory, we assume the Derivative Origin of Species, how simple and intelligible become the great facts of the geographical distribution of species! How easily we can explain the existence of what are known as representative or analogous species, and the occasional existence of identical species, with all the intermediate grades between the two categories, in distinct entomological provinces separated by insurmountable physical barriers, such as are North America and Europe! What Loew remarks of Diptera is, so far as my personal knowledge of the entomological faunæ of England and Illinois extends, equally true of the other Orders of Insects. "The European and the American dipterous faunæ," says he, "always appear to me like two branches of the same stock, each having had a development of its own, very similar however to the development of the other. But if there really was such a common stock for both, it is to be sought among the Diptera of a former geological period, and if the European and the North American dipterous faunæ are to be considered as branches of this stock, the necessary inference would be that at a former period Europe and America had a continental connection. Are the Amber-diptera preserved fragments of this common stock? Did a continental connection between Europe and America really exist at the time when they lived? Did the submersion of an Atlantis tear asunder the branches of this stock?" (*Amber-diptera*, p. 324.)

In another passage Loew remarks, in regard to the resemblance between European and especially North American Diptera and those of the Amber Fauna, that "the relationship between certain species is so strikingly close, that it naturally suggests the idea of a genetic connection, and maintains it against all possible theoretical objections The impression that the living species, connected by such a close link of relationship to some Amber Diptera, are not new additions to the num-

ber of old species, but are, so to say, the transformed old species, is in my opinion irresistible to any unprejudiced observer." (*Ibid.* p. 315.)

II. As Prof. Agassiz has gone out of his way, in his recent "Methods of Study," to offer what he seems to consider as a refutation of Darwin's views on the Derivative Origin of Species, I may be allowed here a few words, in order to demonstrate that he has totally misapprehended and misstated the Darwinian Theory, and appears never even to have given himself the trouble to read Darwin's book through. It is evident, indeed, from his language, that he has approached that book with the same feelings as many men approach a toad or a spider, viz. as something scarcely worthy his notice and disgustful to every rightly constituted mind. "If," he says, (p. 303,) "such views are ever to deserve serious consideration," &c. "They are repugnant," he adds, (p. 317,) "to our better nature." This may be a very good reason for not reading a book, but it is a very poor reason for attempting to refute it without first reading it carefully through at least once. The conservative President of the Linnæan Society in England has recently expressed the opinion, in his Annual Address, "that the tide of opinion among philosophic naturalists is setting strongly in favor of Mr. Darwin's Theory." Some of the first naturalists of the day, for instance, Hooker, Herbert, Huxley, Owen, Lyell, Bates, Wallace, Isidore St. Hilaire, Naudin and as we have just seen Loew, advocate the same or very similar opinions. The "Origin of Species" is a strong book, well weighed and carefully thought out, written by a strong man familiar with all the discoveries of modern science and himself the honored author of many new scientific discoveries. It is utterly impossible, even for a naturalist of such distinguished attainments as Prof. Agassiz, to upset this new theory, like a child's house built out of cards, by the mere weight of his personal authority. Least of all will it answer to set up a man of straw, call it the Darwinian theory, and amuse himself with pulling it to pieces.

It is certainly true that in the "Methods of Study" Mr. Darwin's name is not especially mentioned, in connection with the Theory which it is attempted to refute. But as "the variability of species under domestication" is repeatedly and prominently alluded to in that book, as having been "urged with great persistency in recent discussions upon

this subject" (p. 141, &c.), and Mr. Darwin was the first and only naturalist that made the phenomena of variability under domestication the leading feature in the question, and as moreover it is well understood among the disciples of Prof. Agassiz, that his blows are aimed at the "Origin of Species," it is impossible not to draw the inference that it is to that book that he more especially refers. The mere fact of his quoting in his Preface, *totidem verbis*, in connection with the theory which he proposes to refute, a remarkable phrase first used by Darwin in the "Origin of Species"—"the Imperfection of the Geological Record"—would, alone, be not only moral, but almost legal proof, that it is against the "Origin of Species" that his arguments are chiefly directed. In one word, if he does not refer to that book, to what book can he refer?

In order to substantiate the grave charge made just now against Prof. Agassiz, viz. that he has fundamentally misstated the views of his opponent, it will be necessary to state briefly what the Darwinian Theory really is. Its leading principles may be thus condensed:—

1*st*. Most species, both of animals and plants, vary more or less, whether they are in a state of domestication or in a state of nature.

2*nd*. In the case of domesticated species, man often seizes hold of any given variation that is useful or pleasing, not to the animal or plant, but to himself; and by selecting those individuals that possess that given variation in ever so small a degree, and breeding exclusively from them, gradually, on the well-known principle that "like produces like," or what naturalists call the Law of Inheritance, exaggerates the variation till it assumes very large proportions. Thus from the wild rock-pigeon have been gradually produced the different breeds of fancy pigeons—tumblers, carriers, fantails, &c.—some of which, as Darwin truly observes, differ so widely from the others, that if discovered in a wild state they would be considered by ornithologists as not only specifically but generically distinct.—This process may be called Artificial Selection.

3*rd*. In the case of wild species, Nature seizes hold of any given variation that is useful, not to man, but to the animal or plant itself. And as from the natural rate of increase in every known species, very many more individuals come into the world than can possibly survive to maturity, those individuals that are possessed of this useful varia-

tion gain an advantage over their fellows in the Struggle for Existence, and are thus enabled to jostle them on one side and take their places. By a repetition of this process in successive generations the given variation is gradually, by the workings of the Law of Inheritance exaggerated and swelled into large proportions, until after an indefinitely long period what we call a new species is formed.—This process Mr. Darwin calls Natural Selection.

So far is Mr. Darwin from adopting the old theory, that new species of animals and plants arise *merely and entirely or even chiefly* from what naturalists call the Conditions of Life, i. e. different food, different climate, &c., that he expressly on eight distinct occasions repudiates that theory. Hear him :—

Naturalists continually refer to *external conditions, such as climate, food,* &c., as the only possible cause of variation. In one very limited sense, as we shall hereafter see, this may be true: *but it is preposterous to attribute to mere external conditions* the structure, for instance, of the woodpecker, with its feet, tail, beak and tongue so admirably adapted to catch insects under the bark of trees. (*Origin of Species*, p. 11, Amer. ed.)

Some little effect may perhaps be attributed to the direct action of the *external conditions of life*, and some little to habit; but he would be a bold man who would account by such agencies for the differences of a dray and race-horse, a grayhound and bloodhound, a carrier and tumbler pigeon. (*Ibid.* p. 33.)

In looking at many small points of difference between species, which, as far as our ignorance permits us to judge, seem to be quite unimportant, we must not forget that *climate, food,* &c. probably produce some *slight and direct effect.* (*Ibid.* p. 81.)

How much direct effect *difference of climate, food,* &c. produces on any being is extremely doubtful. My impression is, that the effect is *extremely small* in the case of animals, but perhaps rather more in that of plants. (*Ibid.* p. 121.)

We should remember that *climate, food,* &c. probably have *some little direct influence* on the organization. (*Ibid.* p. 175.)

I fully admit that many structures are of no direct use to their possessors. *Physical conditions* have probably had *some little effect* on structure, quite independently of any good thus gained. (*Ibid.* p. 178.)

The dissimilarity of the inhabitants of different regions may be attributed to modification through Natural Selection, *and in a quite subordinate degree* to the direct influence of *different physical conditions.* (*Ibid.* p. 305.)

The complex and little known laws governing variation are the same, as far as we can see, with the laws which have governed the production of so-called specific forms. In both cases *physical conditions* seem to have produced *but little direct effect.* (*Ibid.* 410.)

It has thus been shown briefly what Darwin's Theory really is. It has also been shown, by numerous quotations from his book, what he expressly states that it is not. It shall now be shown from Prof. Agassiz's book, that it is assumed by that writer to be the very thing which Darwin had repeatedly stated it not to be.

It surely does not follow that because the Chinese can, under abnormal conditions, produce a variety of fantastic shapes in the Golden Carp, therefore *water or the physical conditions established in the water* can create a Fish, any more than it follows that because they can dwarf a tree, or alter its aspect, by stunting its growth in one direction and forcing it in another, therefore *the earth, or the physical conditions connected with their growth*, can create a Pine, an Oak, a Birch or a Maple. I confess that in all the arguments derived from the phenomena of domestication, to prove that animals owe their origin and diversity to *the natural action of the conditions under which they live*, the conclusion does not seem to me to follow logically from the premises. (*Meth. St.*, p. 145.)

It may be added here, that from one end to the other of this book not one solitary word is said about Natural Selection, the Struggle for Existence, or any of the other great leading features of the "Origin of Species," in any shape, manner or form. The whole argument is ignored as completely as if it had never been promulgated; and, as we have already seen, an old, exploded doctrine which Darwin expressly disavows on eight separate occasions, is set up as a target for the dialectic arrows of Prof. Agassiz. Five entire pages (pp. 141–5) are expended in proving triumphantly what nobody denies, and what follows as a necessary consequence from Mr. Darwin's views, viz. that the characters that distinguish wild species are different from those which distinguish domesticated breeds. Surely, if they were *not* different, it would be a fatal objection to Mr. Darwin's theory. The former characters, according to that theory, arise from variations useful to the animal or plant itself; the latter from variations useful or pleasing, not to the animal or plant itself, but to man. We should naturally therefore, arguing *a priori*, expect them to be different as a general rule. Who, that is not bewildered by a preconceived theory, would expect to find in a wild pear the luscious, melting, sweet pulp, which man has gradually produced by Artificial Selection in the cultivated fruit? Or to find in a wolf the disposition to point game, instead of rushing greedily upon it, which man by artificial training, by Artificial Selection, and by the Law of Inheritance, has gradually produced in

the Pointer-dog? Or to find a species of wild sheep with a tail so large and fat, that it has to be supported by a little wagon, as in certain exotic breeds of tame sheep?

That it may not be said that I rely upon a single isolated passage, to substantiate the grave charge brought against Prof. Agassiz, I will quote a second passage to the same effect.

> The influence of man upon animals is, in other words, the action of mind upon them; and yet the ordinary mode of arguing upon this subject is, that because the intelligence of man has been able to produce certain varieties in domesticated animals, therefore *physical causes* have produced all the diversity existing among wild ones. Surely the sounder logic would be to infer, that, because our finite intelligence may cause the original pattern to vary by some slight shades of difference, therefore a superior intelligence must have established all the boundless diversity of which our boasted varieties are but the faintest echo. (*Meth. St.*, p. 142.)

To my mind, the sound logical inference from the above premises would be, that "a superior intelligence *must have caused the original pattern to vary by very great differences*, of which our boasted varieties are but the faintest echo," which is precisely the Darwinian doctrine. But the passage is quoted, not for the sake of criticising its logic, but to prove how utterly the views of Mr. Darwin, or what must be supposed to be those of Mr. Darwin, are misapprehended and misstated.

In opposition to the principles of the Darwinian theory, as expounded above, Prof. Agassiz says, that "there is not a fact known to science tending to show that any being, in the natural process of reproduction and multiplication, has ever diverged from the course natural to its kind" (p. 281); and that the naturalist "never sees any animal diverge in the slightest degree from its own structural character" (p. 318). Now Hagen has shown satisfactorily that the European *Onychogomphus forcipatus* and *Cordulegaster annulatus* diverge most remarkably in their structural characters, in certain localities, from the normal type, and that all the intermediate grades occur in other localities. (*Mon. Gomph.* pp. 28—40, and Plate 2; pp. 333—7, and Plate 17.) Loew has shown the same thing of the European *Gymnopternus Sahlbergii* and *Empis maculata* (*Amber-Dipt.* p. 323); and similar cases are familiar to every well-informed entomologist. Prof. Agassiz may perhaps argue in such instances as these that it is natural to them to diverge thus, and that in diverging thus "they do not diverge from the course natural to

them." But by this mode of arguing in a circle we may prove that no conceivable amount of divergence, that does really occur in a given species, is a divergence from nature.

From what Agassiz says, as to the "close adherence to the distinct, well-defined and invariable limits of the species", in wild species as contra-distinguished from domesticated ones, (*Meth. Study*, p. 145,) any one not familiar with Natural History would infer, that wild species, in the same geographical locality, scarcely vary at all from the normal type. Every field-entomologist knows that, in many species of insects, this is not so. To illustrate from one single Order, Coleoptera: —*Arrhenodes septentrionis* Hbst. and *Catogenus rufus* Fabr., vary exceedingly in size, so that some individuals are full twice as long as others, and in the male of the former of these two species the snout is sometimes full as broad as long, and sometimes on the other hand full twice as long as broad, whence some foreign entomologists have been led to consider the varieties as distinct species. But as numerous intermediate grades occur in all these cases in company with each other, it is evident that the differing forms are mere varieties. Again, as regards the variable length of what are commonly called horns in insects, I have ♂ specimens of *Phanæus carnifex* Lin. with the horn that proceeds from the vertex three times as long as in other specimens, with all the intermediate grades; and the length of the thoracic horns in ♂ *Phellidius* (*boletophagus*) *cornutus* Fabr. and of the mandibles in ♂ *Lucanus elaphus* Lin. is almost equally variable. Finally, to give a few examples of colorational variation, in *Haltica striolata* Fabr many individuals occur with the pale elytral vitta resolved into two roundish pale spots, so that Fabricius described them as a distinct species under the name of *bipustulata*. In *Haltica alternata* Illig. some specimens have the normal 5 black vittæ on the elytra, and some have perfectly immaculate elytra, with all the intermediate grades. In *Cerotoma camínea* Fabr. some specimens have the two normal discoidal black spots of each elytrum confluent so as to form a black vitta, and I have a single specimen with the elytra entirely immaculate except the triangular black spot on the scutel, and a similar one with faint traces only of the normal markings; and analogous variations occur in *Œdionychis quercata* Fab., *Œ. 6-maculata* Illig. and *Blephacida rhois* Forst. In *Melasoma* (*lina*) *interrupta* Fabr. some spe-

cimens have the elytra almost entirely yellow with only 4 small black dots, some with 16 more or less large black spots which are more or less confluent, and some entirely black with the exception of a narrow marginal line. In *Myzia* 15-*punctata* Oliv., in the mature living insect, the elytra vary from pale yellowish through different shades of brick-red to so dark a reddish brown that the black spots are with difficulty discernible. And, as I can state from a long series of specimens formerly in my collection in England, the European *Donacia Proteus* varies in color from indigo blue through purple and violet to bright ruby red, and so on to metallic yellow, metallic yellowish brown, reddish brown and brown. There is no domesticated animal that exhibits anything like so great a range of variation in its coloration. The simple fact that naturalists are puzzled every day to decide in the case of wild species, whether differing forms are varieties or species, proves that in a state of nature extensive variations do occur. To say that such variations are included in "the invariable limits of the species" is little else but an abuse of language.

It is very true that we cannot say whether any of these wonderful variations have arisen within a comparatively recent period. But this is simply because Natural History, as a science, dates only from the days of Linnæus. Of all the insects referred to by ancient writers, scarcely a single species can be identified with certainty from their loose and unsatisfactory notices, as we may learn from the interminable modern disputes as to the true significance of the ancient *Cossus*, *Cantharis*, *Cicindela*, *Œstrus*, *Buprestis*, &c. Even Linnæus and his immediate followers published no *descriptions* of species, in the modern sense of the term, but only meagre and imperfect *diagnoses*, whence it continually results that it is impossible to decide from the diagnoses themselves, to which of half a dozen distinct species their specific names are properly applicable. Twenty generations hence our descendants may begin to generalize on the permanence of specific types in insects. To attempt to do so now, is to build castles in the air. If we had full descriptions of any species dating from the days of Aristotle and Theophrastus, we might then form some estimate of the variability of those species within the last 2000 years. At present it is only possible for us to accumulate materials, upon which many centuries hence our remote posterity may begin to speculate. That in-

sects never vary materially *in time*, no man can prove; but that they do sometimes vary most astonishingly *in space*, and run into what are known as geographical races, there is the fullest and most reliable evidence. To give another example, in addition to those already quoted:—*Calosoma luxatum* Say, *C. striatulum* Lec. and *C. Zimmermanni* Lec. were formerly considered by Dr. LeConte and others as perfectly distinct species. But Mr. Ulke tells me that "on showing a large series comprising all the intermediate grades—viz. from Kansas *luxatum* from Nebraska Idaho and Utah *striatulum*, and from Oregon and California *Zimmermanni*—to Dr. LeConte. he was then convinced of their identity," and they are accordingly in his recent List of N. A. Coleoptera classified as mere geographical races.

It is singular that in attempting to prove the immutability of *species*, from the historic evidence of "the animals preserved by the ancient Egyptians within their tombs or carved upon the walls of their monuments," besides "the Apis. the Ibis. the Crocodiles and the sacred Beetles," Agassiz quotes *the Negro* as "the same woolly-haired, thick-lipped, flat-nosed, dark-skinned being in the days of the Ramases that he is now." (*Meth. St.* p. 150.) Hence one of two consequences necessarily follows, either that, in the opinion of Prof. Agassiz, the negro is a distinct species of the genus Homo, or else, if he is merely a variety, that varieties are, in this one case at all events, as immutable as species, which destroys the whole force of the argument. It further follows, in the latter case, that there do exist such things as geographical divergences not only in coloration but in structural characters. As to the Sacred Beetles of the Egyptians, I am not aware that any specimens have ever been discovered preserved in mummies or sarcophagi, and the rude sculptures of them by ancient Egyptian artists which may be seen in the British Museum are so uncharacteristic, that not only is it utterly impossible to identify the species, but they might just as well pass for *Geotrupes* or even for *Nitidula* or *Philhydrus* as for *Canthon*. Prof. Agassiz must surely know, that it is sometimes impossible to identify insects specifically, even from the very best modern colored drawings, unassisted by descriptions. Is it likely then that they can be identified from sculptures of the rudest and most primitive character?

Instead of recognizing the demonstrable fact, that in a state of nature

many species vary both in coloration and structural characters, not only in different geographical localities, but even in the same locality, Agassiz seems to suppose that variation and divergence from the normal type are peculiar to domesticated species. "Nature," he says, "holds inviolable the stamp that God has set upon his creatures; and if man is able to influence their organization in some slight degree, it is because the Creator has given to his [man's?] relations with the animals he [the Creator?] has intended for his [man's?] companions the same plasticity which he [the Creator?] has allowed to every other side of his [man's?] life." (*Meth. St.* p. 147.) So far as the meaning of this most obscure and mystical sentence can be guessed at, it is asserted that the Creator conferred the quality of variability upon such animals as he intended to be domesticated by man, but not upon those which he intended to run wild; and since the ass, the guinea-fowl, the honey-bee* and the silk-worm vary scarcely at all in a state of domestication, and certainly vary not one-hundreth part as much as many species which are not domesticated, it follows, according to what seems to be the doctrine of Prof. Agassiz, that the Creator never intended these animals to be domesticated, and consequently that any man that keeps them in a state of domestication violates the laws of God!

Herbert Spencer has remarked of Hugh Miller, that he "fell short of that highest faith, which knows that all truths must harmonize, and which is therefore content trustfully to follow the evidence whithersoever it leads." (*Illustr. Universal Progress.*) The more closely we examine the recorded opinions of Prof. Agassiz, the more inclined shall we become to believe, that there is the same radical defect in the constitution of his mind.

---

* The Italian bee (*Apis ligustica* Spin.) is not a variety but a distinct species, and has been of late years extensively propagated in this country by introducing fertilized queens into hives of the ordinary species. Hence one interesting fact has already been arrived at, viz. that in the space of about 3 or 4 months the whole working population of the hive possessing an Italian queen comes to consist of the Italian species, whence it results that working bees live in the imago state only about 3 months. Virgil describes the queen-bee as marked with bright, golden spots, (*maculis auro squalentibus ardens*, Georg. iv. 91), so that it would seem that the Italian bee was the only species known to him. From not attending to the peculiar characters of this species, Kirby and Spence have denied the accuracy of Virgil's description. (*Introd.* Letter 19, p. 377.)

III. "There are many Insects," says Agassiz, "that pass through their metamorphoses within the egg, appearing as complete Insects at the moment of their birth; but the series of changes is nevertheless analogous to that of the Butterfly, whose existence as Worm, Chrysalis and Winged Insect is so well known to all. Take the Grasshopper for instance: with the exception of the wings it is born in the mature form; but within the egg it has had its Worm-like stage, as much as the Butterfly that we knew a few months ago as a Caterpillar." (*Methods of Study*, p. 237.)

For a long time I have noticed in the winter and spring, under the scales of a gall like a pine-cone growing on a species of willow, (*Salix cordata* Muhl., as kindly determined for me by Mr. M. S. Bebb of Washington,) and called *strobiloides* by Baron Osten Sacken, great numbers of singular, yellowish, cylindrical, exarticulate, semitransparent bodies, .16—.17 inch long, about seven times as long as wide, rounded at each end, and a little tapered towards what afterwards proved to be the anterior end. Sometimes in a single gall there were over a dozen of them, and I supposed them at first to be the pupal cocoons of some inquilinous *Cecidomyia*. When opened early in the spring, they contained nothing but an apparently homogeneous, subviscid, yellowish fluid, but about the beginning of May I noticed that egg-yellow matter had accumulated in their anterior half, and about the middle of May two large black eyes became visible in many specimens through the semitransparent external integument, about $\frac{1}{3}$ of the way from the anterior end. On May 26 there hatched out from two of these bodies, which I had insulated in a vial along with several score of others, little Orthoptera belonging to the genus *Orchelimum*, destitute of any vestiges of wings, but otherwise formed, as is usual, very much like the perfect insect. When first hatched, they were all pale green except the eyes, but they afterwards rapidly acquired blackish markings. I had long ago noticed that the imago of a species of *Orchelimum*, perhaps *glaberrimum* Burm., haunted another species of willow which grows in an entirely different locality—*Salix nigra* Marshall according to Mr. Bebb—but which bears no galls at all resembling *strobiloides* O. S. On carefully extracting the insect from an egg which showed the black eyes rather conspicuously, I discovered that its body was so much elongated, as it lay stretched out at full length in the egg, as to

be about six times as long as wide, the insect occupying the entire egg except the anterior one-seventh part which was empty, and always making its exit by bursting or gnawing a slit through the shell of the egg just behind the empty part.

No doubt, before the legs of the little *orchelimum* were well developed, a lively imagination might have detected a strong resemblance between the embryo insect, as it lay in the egg, and the worm-like larva of many Lepidoptera. But are we thence to conclude that this worm-like stage in the egg is homologous to the worm-like larva state of Lepidoptera and other Orders of insects? Several facts seem to forbid such an inference.

1*st*. The egg of the Catydid (*Platyphyllum concavum* Harr.) of which egg I possess specimens and which is described by Harris, (*Inj. Ins.* p. 158.) is only about ½ longer than wide, and consequently the young Catydid can scarcely be elongate and worm-like in any stage in the egg, unless it is curled up head and tail together. But the egg of a species of Œdipoda which I once hatched out, (probably *Œ. Carolina* Lin.) was about three times as long as wide, cylindrical and rounded at each end, and Harris describes the eggs of such *Gryllidæ* Leach (=*Locustariæ* Latr.) as oviposit in the earth, as being "elongated and nearly of an ellipsoidal form." (*Inj. Ins.* p. 156.) Consequently, as I know that the embryo *Orchelimum* is not curled up in the egg, and there is a regular gradation in the shape of the egg from *Orchelimum* to *Platyphyllum*, it is not probable that any Orthoptera Saltatoria can ever be curled up in the egg, as is the case with many Lepidoptera, the eggs of which are generally more or less spherical; whence we may conclude that the embryo Catydid is probably only about one-half longer than wide and is therefore not at all "worm-like."

2*nd*. Many lepidopterous larvæ are anything but worm-like. The larva of *Limacodes scapha* Harr. and generally all Limacodian larvæ, and the larva of *Papilio Podalirius* (Europe) which is said to be "snail-like," may be quoted as examples. Are we to conclude, therefore, that these larvæ pass their worm-like stage in the egg, like Grasshoppers, and are born as mature insects, with the exception of the wings? And if not, why not?

3*rd*. No insect moults its external integument, after assuming the pupa state, until its final change into the imago, and no imago moults

at all. If then the young Grasshopper, when it leaves the egg, is a pupa, it will only moult once before it becomes an imago; and if, as Agassiz seems to assert, it is an imago when it leaves the egg, it will not moult at all. Now what are the facts? Westwood, the most invariably accurate of all modern entomologists, says that Orthoptera ordinarily moult six times, viz. four times in the larva state, once when they pass into the pupa state, and once when they pass into the imago state (*Intr.* I. p. 411); and this is pretty generally the rule with all insects. Indeed, if they do not moult after hatching out from the egg, how are they to grow? An insect has a horny skeleton on the outside to which its muscles are attached, just as a Crustacean has a calcareous skeleton on the outside to which its muscles are attached; and neither skeleton is susceptible of gradual enlargement, like the internal skeleton in Vertebrata, which is the reason of the well-known fact that the Imago in insects cannot grow. Hence, instead of *shedding their flesh and sitting in their bones*, as Sidney Smith proposed to do in hot weather, both are compelled from time to time to *shed their bones and sit in their flesh*, until Nature provides them with a new skeleton, which in its turn will be thrown off so soon as they have outgrown it.

4*th*. If the young Grasshopper, at the moment of its exclusion from the egg, was in the imago state, its reproductive system would be already fully developed and active. Every field-entomologist knows that it is not so, and that even with those species which in the imago have wings scarcely longer, though considerably broader, than in the pupa, the pupa is never found in copulation.

On the whole, considering the enormous variation in the shape of those larvæ, which even Prof. Agassiz will allow to be true larvæ and not mere wingless imagos, running through all the intermediate grades from the short, squat, almost spherical larva of *Copris Carolina* (*Proc. Ent. Soc. Philad.*, Vol. I. Plate I. fig. 1.) to the very elongated, worm-like larva of most *Elateridæ*; and considering also how loose and indefinite are such phrases as "worm-like," it seems rather unphilosophical to base a scientific theory upon so shifting a foundation.

IV. As we have seen that Prof. Agassiz traces a vague analogy between the larva state of insects and the true Worms, so he traces

another vague analogy between the pupa or what he calls the Chrysalis state of insects and the Crustacea. (*Methods of Study*, pp. 237, 312.) But in Crustacea the head is soldered to the thorax without any suture, while in the pupa of Lepidoptera, Hymenoptera, Coleoptera, Diptera and the true Neuroptera, which even Agassiz does not assert to pass the larval and pupal states in the egg, the head is connected with the thorax by a very distinct connate suture, and in many Coleoptera, especially Tetramera, and most Hymenoptera and Neuroptera there is, in addition, a very distinct constriction or neck at this suture, thus offering not even the faintest resemblance to the Crustacean Cephalothorax. I say nothing of the other Orders or Suborders, where there exists a perfectly free suture between the head and the thorax of the pupa, because these are probably the very groups which Agassiz believes to pass the larval and pupal states in the egg. In another passage an analogy is traced between, on the one hand, the larva state of insects and the elongated, worm-like Centipedes, (Myriapoda,) and, on the other hand between the pupa state of insects and the spiders (Arachnida) with their head and thorax confluent as in the Crustaceans. (*Ibid.* pp. 75–6 and compare p. 312.) To this last analogy there is precisely the same fatal objection as to the first.*

*There is a remarkable genus of ant-like spiders—whether described or not I do not know, though it is not mentioned either by Latreille or Say—with a very strong medial constriction in the thorax so as to appear to have a distinct head. This seeming head is subquadrangular, and bears a small eye at each of the four angles and on the depressed frontal surface two enormously large ones, each nearly ⅓ as wide as the head, making six in all. But there is no connate suture or free articulation whatever at the constriction, as I ascertained from the recent specimen, and the front pair of legs arise from this seeming head and not from the other part of the thorax. The posterior pair of legs are much longer than the others, the other 3 pair alike in every respect. The palpi are about ½ as long as the front legs, 3-jointed, each successive joint slightly shorter than the preceding. The other parts of the mouth are small and indistinct. If undescribed, this genus may be called *Myrmecarachna*, from the great resemblance to the worker ant. In the Scorpionide genus Chelifer, also, of which I possess *Ch. oblongus* Say, the thorax is divided by two transverse slightly indented lines into 3 portions, the anterior one of which bears the eyes and the brachiform palpi and the other two portions the 4 pairs of legs.

V. In the course of this last speculation, one of the proofs offered is, that "the earliest condition of an animal cannot be its highest condition—it does not pass from a more perfect to a less perfect state of existence." (*Ibid.* p. 75.) This is generally, but not universally, true. Westwood has well observed that "the case of the bark-lice (coccidæ) clearly proves that annulose animals may exist, which become more and more imperfect as they approach the imago state;" and that in that state the females "lose all trace of articulations in the body as well as of articulated limbs, becoming in fact inert and fixed masses of animal matter, motionless and apparently senseless." (*Intr.* II. p. 444.) Again, in some genera of the Crustacean Cirripedes, (barnacles, &c.) according to Darwin, "the larvæ become developed either into hermaphrodites having the ordinary structure, or into what are called complemental males; and in the latter the development has assuredly been retrograde; for the male is a mere sack, which lives for a short time, and is destitute of mouth, stomach or other organ of importance, excepting for reproduction." (*Origin of Species*, p. 384.) Prof. Dana, who denies the theory of Agassiz that Lepidoptera are the highest insects, which is based upon the above assertion, and who maintains that Hymenoptera are the highest, quotes the adult, attached, plant-like condition of the defunctionate Barnacle or Anatifa, and of other species which become attached in the adult state, as another example of general decline in grade in the adult state. (*Silliman's Journal*, May, 1864, p. 19, note.) So far as regards the question of the relative superiority of the different Orders of Insects, it cannot, I think, be decided from the consideration of any one character, whether the nature of the metamorphosis upon which Agassiz chiefly relies, or the functions of the wings upon which Dana chiefly relies; but upon a general review of all the characters of each Order. The first method is artificial, the second natural.

VI. Prof. J. D. Dana has recently published an entirely new Classification of Insects, based, as he says, upon his new principle of Cephalization. (*Silliman's Journal*, Vol. 37, pp. 10—33.) The following Table represents in a condensed form the leading features of this very ingenious, but somewhat vague and indefinite arrangement.

PTEROPROSTHENICS.---Front wings not elytriform.

I. APIPENS.—Wings like those of a bee.

1. **Hymenopters.** Perterrestrial. Permaturative.*
2. **Dipters.** Mostly perterrestrial. Permaturative.
3. **Aphanipters.** (Fleas.) Perterrestrial. Permaturative.

II. AMPLIPENS.—Wings large.

1. **Lepidopters.** Perterrestrial. Permaturative.
3. **Homopters.** Perterrestrial. Prematurative.
3. **Trichopters.** (Phryganeids.) Semiaquatic. Permaturative.

III. ATTENUATES. (Neuropters.)---Body, legs and wings slender.

1. **Apipenniforms.** Perterrestrial. Permaturative or prematurative.
   a. Termitideans. Hymenopteroid.
   b. Panorpideans. Dipteroid.
   c. Group unknown. Aphanipteroid.
2. **Amplipenniforms.** Perterrestrial or semiaquatic. Permaturative or prematurative.
   a. Planipennians. Lepidopteroid. (Myrmeleontids, Hemerobiids, Nymphids,† Mantispids and Semblids.)
   b. Psocideans. Homopteroid.
   c. Perlideans. Trichopteroid.
3. **Perattenuates** or Typical Neuropters. Semiaquatic. Prematurative.
   a. Libellulideans.
   b. Ephemerideans.

PTEROMETASTHENICS.---Front wings elytriform.

1. **Coleopters.** Mostly terrestrial. Permaturative.
2. **Hemipters.** (Heteropters and Pediculids.) Mostly terrestrial. Prematurative.
3. **Orthopters.** Terrestrial. Prematurative.
   a. Cursors. Coleopteroid. (Forficulids and Blattids.)
   b. Ambulators. Hemipteroid. (Mantids, Phasmids and Nirmids.)
   c. Saltators or typical Orthoptera.

THYSANURES or APTERS.---Wingless.

1. **Lepismians.**
2. **Podurians.**
2. **Unknown degradational group.**

---

* By "perterrestrial" as opposed to semiaquatic," Prof. Dana means that the larva is not aquatic with aquatic respiration, and by "permaturative" as opposed to "prematurative" that the imago is altogether unlike the larva, or as it is commonly phrased, that the metamorphosis is complete.

† I am unable to conjecture what Neuropterous group is here referred to by the term "Nymphids." No such family or genus is mentioned either by Latreille, Westwood, Hagen or any other writer known to me. It cannot be the

"The number of subdivisions in the groups, both the lower and the higher," says Prof. Dana, "is *three*, as in most of the Classes and Orders that came under consideration in Article 1st." (p. 27.) Yes, but this symmetry is only obtained by making Aphaniptera (the fleas) of equal systematic value with Hymenoptera and Diptera, and Trichoptera of equal value with Lepidoptera and Homoptera; by splitting up what remains of Neuroptera, after removing Trichoptera, into three groups of equal value with Hymenoptera, Diptera, &c.; by placing Homoptera in the first Primary Division, and the closely allied Hemiptera (heteroptera) in the second Primary Division; by uniting Forficulidæ and Blattidæ together as Cursors, and Mantidæ and Phasmidæ together as Ambulators; and finally by assuming the existence of an unknown aphanipteroid group in the Apipenniform Attenuates, of an unknown degradational group in Aptera, and as it should seem, though Prof. Dana does not expressly say so, of a third unknown group, to complete the mystical number *three*, in the Perattenuate Attenuates.

I protest, in the name of science, against this arithmetical monomania, which is perpetually seeking to fetter the limbs of Nature in mathematical formulæ. The world has had about enough of ternary, quinary and septenary systems; but from the fatal facility with which they are generated, it does not seem likely that the breed of them will very soon run out. Nothing is easier than by subdividing some natural groups and uniting others, and by giving prominence to certain characters and keeping others in the back ground, to form an artificial system of classification based upon any assignable arithmetical number from *two* up to *ten*. And when such systems are formed, what are they worth? Absolutely nothing.

It is perhaps hypercritical to quarrel with a mere name, but we can scarcely fail to observe that this new system of Prof. Dana's is not, as it professes to be, based upon his principle of Cephalization. As originally expounded by him in Crustacea, Cephalization consists in "the transfer of the anterior members of the thorax to the cephalic series,"

---

subfamily *Corydalides* West., because the "Nymphids" are classed as "perterrestrial," (p. 22.) The only other Neuropterous group left unnamed by Prof. Dana is *Rhaphidiidæ* Westw., which Hagen unites with *Sialina=Semblids* Dana, and *Embidina* Hagen, which had previously been referred to *Termitina*. Nymphidia is a genus of Butterflies.

(*Sill. Journ.*, Vol. 35, p. 66,) or in other words in *legs* being converted into *head-organs*. And in Crustacea this character really appears to be of high systematic value. It by no means follows, however, as every Naturalist is well aware, that because a character is of high systematic value in one group, it will be of equally high value, or of any value at all, in another group. The neuration of the wings is of high systematic value in most Orders of insects, but in Coleoptera it is utterly worthless, or at all events, according to LeConte, "no results of importance for classification have yet been obtained by the study of the venation of these organs." (*Intr. Col.* p. xviii.) Again, in Odonata the neuration is very constant in the same species and differs very much in different genera; whereas in the closely allied Perlina the neuration is very inconstant in the same species, insomuch that the number of subterminal cross-veins varies from 2 to 12 in different specimens of the same species (*Acroneuria abnormis* Newm.), and in the right and left wing of the same specimen there is sometimes a difference of 4 subterminal cross-veins, (*Acr. abnormis* Newm. and *Perla varians* Walsh); while on the other hand the neuration of this family differs comparatively but little in the different genera. Hence it results that in Odonata the neuration is of the highest systematic value, and in Perlina of much lower value.

If we apply the principle of Cephalization in its original signification to Insects, we shall find that there are certain families and genera, e. g. in Orthoptera *Mantidæ*, in Neuroptera *Mantispa*, in Heteroptera *Myodocha*, *Phymata*, *Macrocephalus*, *Syrtis*, *Reduviidæ* and *Nepidæ*, and in Diptera *Hemerodromia*, which have what are commonly known as raptorial front legs; in other words the front legs are used, not as *legs* but as *arms* to catch their prey with. In other species, e. g. the dipterous *Calobata antennæpes* Say, which takes its name from that peculiarity, and in many Nemocerous Diptera, the front legs are not used at all for locomotive purposes, but are elevated in the air and vibrated after the fashion of antennæ. Here therefore it is strictly true that "the anterior members of the thorax are transferred to the cephalic series;" and if, as Prof. Dana maintains, the cephalization of the anterior pair of limbs in Man, or in other words the conversion of his front limbs into arms, "places Man apart from the whole series of Mammals" (*Sill. Journ.*, Vol. 35, p. 68), then by parity of reasoning, if the principle of

Cephalization is universally applicable, all the above-mentioned families and genera of Insects ought to be placed in a group by themselves.

Instead of doing this, however, Prof. Dana has based his new Classification primarily, not upon the functions of the front legs, of which he takes no notice whatever, but upon the functions of the wings, according to the greater or less degree in which the front wings are thickened, so as to perform the function, not of wings, but of elytra or wing-cases. It is difficult to see how, even in Coleoptera where the front wings are completely useless for flying and merely serve to protect the hind wings in repose, those organs are any more "cephalized" or converted into head-organs than in his Pteroprosthenics. At all events, if Coleoptera are inferior to Diptera, because their flying organs are placed further back from the head, Diptera must be superior to Hymenoptera, because the Dipterous wing is placed one half-segment nearer to the head than the central point common to the front and hind wing in Hymenoptera; whereas, according to this new system, Hymenoptera are superior to Diptera.

The minor divisions of this system are based either upon loose, indefinite, unexplained resemblances, such as that of the wings of the Apipens to the wings of a bee, the Aphanipterous Apipens having only the merest rudiments of wings, or upon vague statements of the comparative largeness of the wings or the comparative slimness of the body and its appendages, (Amplipens and Attenuates,) which although generally are by no means universally true—witness the narrow, lanceolate, almost thread-like wings of many Microlepidopterous Amplipens, and the short, robust bodies of the Psocidian Attenuates—or finally upon fanciful analogies, which are occasionally founded upon the erroneous statements of preceding authors, as will be hereafter shown in the case of Perlina. In none of these minor divisions is there any attempt whatever made to trace any connection with the head, and therefore, so far as they are concerned, the name of Cephalization is certainly a misnomer.

But allowing that the more or less partial conversion of the front wings into elytra amounts to a decephalization, and allowing still further that the character of cephalization is of high systematic value in Insecta, surely instead of classing Hemiptera (heteroptera) as inferior to Coleoptera, and Orthoptera as inferior to Hemiptera, we ought to

adopt the exactly opposite arrangement. For Coleoptera have the front wings entirely elytriform, Hemiptera (heteroptera) only about one-half elytriform, and Orthoptera scarcely or but slightly elytriform. These groups therefore, according to Dana's own principles, ought to stand 1 Orthoptera, 2 Hemiptera, 3 Coleoptera, instead of 1 Coleoptera, 2 Hemiptera, 3 Orthoptera. But this would necessitate the abandonment of the idea, that the Cursorial Orthopters are coleopteroid and the Ambulatorial Orthopters hemipteroid, or else destroy the symmetry of the analogies that run through the whole system. Consequently, for the sake of symmetry, the very principle upon which the whole system professes to be founded, has been violated.

Although Prof. Dana takes no notice whatever of the above-mentioned very remarkable "Cephalization" of the front legs in certain families and genera of insects, he observes that "as there are *ptero*prosthenic and *ptero*metasthenic insects, so there are *podo*prosthenic, or those in which the anterior legs are stronger than the posterior, and *podo*metasthenic, or those in which the posterior are the main organs of locomotion. Fleas and grasshoppers," he continues, "as they use their hind legs for leaping, are examples of the latter; and this sthenic difference in the feet, though of less weight as a mark of grade than that in the wings, is of real value among inferior subdivisions," (p. 14.) He subsequently remarks that the fact of the Grasshoppers, &c. (Orthoptera Saltatoria) "being strongly podometasthenic is a mark of low inferiority," (p. 25.)

It is observable that in the single Order Coleoptera, the genus Laccophilus in the family Dytiscidæ, the genus Scirtes in the family Dascyllidæ, the genus Orchesia in the family Melandryidæ, the genus Orchestes in the family Curculionidæ, the whole subfamily Halticidæ, and the genus Blepharida in the family Chrysomelidæ, are all "podometasthenic" and have thickened and saltatorial hind legs. If this peculiarity is really, as Dana asserts, "a mark of low inferiority," it is singular that it should occur in Coleoptera in so apparently capricious a manner. Even when it runs through a whole subfamily, as in Halticidæ, it would be difficult to give any other reason than the absence of saltatory power, why Galerucidæ, which do not jump, are superior to the very closely allied Halticidæ, which jump vigorously.

VII. As might be naturally expected from the fact that Entomology is not Prof. Dana's speciality, there are a few slightly erroneous statements scattered here and there throughout his Paper, some of which I shall now proceed to notice.

1. The wings of Apipens are said to be "free from scales and other defunctionating appendages or impediments," and to be "rapid in motion," (p. 15.) But the wings of the Dipterous *Cecidomyia*, for example, are covered with short, appressed hairs and ciliated with long hairs, and the Nemocerous genera *Erioptera* (woolly-wings) and *Lasioptera* (shaggy-wings) take their names from similar peculiarities; and Loew well remarks that "most nemocerous diptera are poor fliers." (*Amber-diptera*, p. 308.)

2. "Hymenoptera," we are told, "are the most uniform in shape or size of Apipens. * * Among them there are no imitations of the forms in other tribes, while they are extensively copied after—a characteristic peculiar to a type of the very highest grade," (p. 15.) Surely Aphaniptera (the fleas) are far more uniform in shape and size than Hymenoptera, which run from two inches long to an almost microscopic minuteness. Again, if names prove anything in this rather indefinite and imaginative matter of imitative forms, there is among the bees a *Xylocopa tabaniformis* Smith, among the ants a *Cryptocerus araneolus* Sm., among the fossorial wasps a *Mutilla arachnoides* Sm. and *M. araneoides* Sm., and among the Ichneumons an *Amitus aleurodinus* Hald.

3. A passage from a Paper by A. S. Packard, Jr., is quoted with approbation, (p. 16, note,) in which that writer, referring to *Laphria**

*Say remarks of the genus *Laphria* that "the larvæ live probably in the earth," and Westwood says generally of *Asilidæ* that "the larvæ reside under ground and feed on the roots of plants." (Say I. p. 11, and Westw. *Intr.* II. p. 549.) I have bred many specimens of *Laphria fulvicauda* Say, from pupæ which occurred sparingly under the bark of black oaks which had been felled a year or more. This species therefore cannot feed in the larva state on living vegetable matter, and probably feeds on subcortical larvæ. As a general rule, I believe that species that are insectivorous in the imago state, which it is well known that the *Asilidæ* are, are insectivorous in the larva state also; though there are whole groups, e. g. *Ichneumonidæ*, that are insectivorous in the larva state but feed in the imago state on honey and pollen. Some day or other, when the practical importance of Economic Entomology shall be more generally recognized, this matter of insectivorous larvæ will be more carefully looked into.

as an imitative or "synthetic" type of *Bombus*, observes that "*Laphria* closely apes the humble-bee in its form, coloration, size and flight, even to the buzz which is, if anything, still louder. * * The plump bee-like form and the dense yellow and black hirsuties, which cause them to be mistaken for humble-bees by persons unacquainted with their structural differences, are just those features that are exceptional in the Diptera and are normal in the Hymenoptera." But, 1*st*, a "plump, bee-like form" is by no means universal in all *Laphria*, as may be seen at once from the figures in the sixth Plate in Say's Works. 2*nd*. The colors yellow and black are by no means universal in all *Bombus*. Several European species, e. g. *B. lapidarius* Fabr., are rufous and black, and a dozen N. A. species described in Mr. Cresson's Paper are partly reddish. 3*rd*. The colors yellow and black are by no means universal in all *Laphria*. In some, e. g. *L. fulvicauda* Say and *L. saniosa* Say, the colors are fulvous and black or sanguineous and black, and some are all black with short cinereous hairs, as *L. dorsata* Say and *L. macrocera* Say. 4*th*. "Hirsuties" is by means universal in all *Laphria*. *L. dorsata* Say, as may be readily seen from Say's figure, is nearly smooth. Mr. Packard seems to have had in his mind only two or three species of *Laphria*—*thoracica* Fabr., *flavicollis* Say and *tergissa* Say, the last of which certainly "buzzes" very much like a *Bombus*—when he established his sweeping generalizations. 5*th*. Instead of "hirsuties" being the *rule* in Hymenoptera it is the *exception*, neither would it be a very easy matter to prove that there are more hairy species in Hymenoptera than in Diptera, especially if we take into account the extensive bristly family of *Tachinadæ*. The great bulk of Hymenoptera, whether we consider the number of genera or of species, belong to the Parasitic families, *Ichneumonidæ*, *Chalcididæ*, *Proctotrupidæ*, &c., and I do not know a single species of them that is at all hairy. The only hairy Tenthredinidous genus that I am acquainted with is *Trichiosoma*. *Urocerida*æ and *Cynipidæ* are none of them hairy, nor, so far as I am aware, are any of the Fossorial Wasps or the Ants or the true Wasps hirsute, except a few *Scoliidæ* and *Mutillidæ*, which are slightly so. Even among the bees, which Mr. Packard seems to have had exclusively in view, there are, as is well known, whole groups which have no "hirsuties" whatever. Neither is it the case, if we look through all the families, that "plumpness" is any more charac-

teristic of Hymenoptera than of Diptera. I know no Dipteron that comes anywhere near the very elongate and attenuate form of the Hymenopterous *Pelecinus polycerator* ♀ Drury.

I do not wish to be understood here as doubting or denying the fact, of there being often a very striking resemblance between insects belonging to different Orders and different families of the same Order, but only the assumption that is made, that of two similar forms, A and B, it is B that imitates A, not A that imitates B, and the inference drawn therefrom, that the group to which A belongs is superior to that to which B belongs. Because an *Ægeria* is named *bombiformis*, it is concluded that it is *Ægeria* that imitates *Bombus*, not *Bombus* that imitates *Ægeria;* but when a Dipterous genus is named *Bittacomorpha* from the Neuropterous genus *Bittacus*, the corresponding conclusion that the Dipteron imitates the Neuropteron is passed over in silence. The Dipterous *Toxophora ægeriiformis* Westw., as its name denotes, imitates an *Ægeria;* but according to Dana's theory, it must be the *Ægeria* that imitates the *Toxophora*, not the *Toxophora* that imitates the *Ægeria.* All that we can safely say in this matter is what Latreille said long ago, viz. that "Nature seems to work after a certain limited number of patterns, which she reproduces with modifications in widely distinct classes and orders;" (quoted Westw. *Intr.* I. p. 326, note); in other words, to drop all metaphorical language, that there appears to be a genetic connection between widely removed species of the same subkingdom. That this iteration of peculiar types is sometimes confined to single species, is proved by the fact of the long, uniquely-shaped tail in the hind wings of a North American moth, *Attacus luna* Linn., being exactly reproduced in the hind wing of a North American butterfly, *Hesperia* (*goniloba*) *proteus* Godart, the other *Attacus* having no vestiges of any tail and the other *Goniloba* having only a short rudimental one. The great truth, which was foreshadowed years ago by the illustrious French entomologist, is also deducible from a fact which Prof. Dana has well insisted on, viz. that in the several Classes and Orders of Annulata there exist definite limits of size, within which each is confined, and which differ materially in the different Classes and in the different Orders. Still more obvious is this law in the case of the inferior subdivisions, such as families, subfamilies and genera; and the lower down in the series we go, or in other words the closer the

genetic connection becomes, the narrower become the limits within which each group is confined. The coleopterous genus *Lucanus*, for instance, varies in length from about 2 to 1 inch, while the coleopterous genus *Trichopteryx* never exceeds $\frac{1}{20}$ inch in length. Unless we are satisfied with Uncle Toby's philosophy, that it has pleased God to make them so, it is difficult to conceive of any possible reason, why, if every species was independently created, there should not exist *Lucanus* as small as *Trichopteryx*, and *Trichopteryx* as large as *Lucanus*.

There is another assumption often made by writers in regard to this matter of imitative forms, which I think is equally unsupported by facts. Several parasitic insects have a strong general resemblance to the insects upon which they are parasitic, though in a Natural Classification they are widely distinct, e. g. certain species of *Volucella* and *Bombus*. Hence it is inferred that the parasite is mistaken by the insect upon which it preys for an individual of its own species. (Kirby & Sp. *Intr.*, Letter 21, p. 407.) But to assume this is to assume, not only that insects are far more stupid than from long observation I believe them to be, but also that the senses of Annulata are homologous to the senses of Vertebrata, whereas such facts as Bees flying home in a straight line through the densest forests and male moths flying down chimneys to reach their females, prove that some of their senses at all events must be constructed on a different type. There is no proof whatever that substances which seem to us exactly of the same color appear to insects of the same color. The yellow hairs of one insect may to them seem red and the yellow hairs of another blue, just as certain human eyes are what is called "color-blind," and by candle-light to most of us blue appears to be green. The *Volucella* certainly looks like a *Bombus* in our eyes, but it by no means follows that it looks like a *Bombus* in the many-facetted organs, which we call eyes, of the *Bombus* itself. Just so, the stars in the firmament appear, it is said, in our eyes like the luminous dots in the Ovarian egg, but it by no means follows, as Agassiz suggests, that in the eyes of an Omnipresent Creator, which are not subject as ours are to the laws of perspective, the stars in the firmament have such an appearance, and therefore that "the thoughts which have been embodied in the universe are recalled within the little egg." (*Methods of Study*, p. 288.) Of the whole number of parasitic insects certainly not one in a hundred

resembles in our eyes the insect it preys on, and the fact of the hundredth parasite being alike may well be attributed to chance, or to speak with more precision to the genetic connection between all Annulata. If "imitative" forms only occurred in parasitical families in such species as prey upon the species which they imitate, there would be more plausibility in the common hypothesis; but it is not so. *Conops sagittaria* Say, as Harris has remarked, (*Inj. Ins.* p. 611,) "might almost be mistaken for a *Eumenes*," and in the shape of its abdomen *Conops* also recalls the fossorial genus *Trypoxylon* and the ♂ of the Evaniide genus *Pelecinus*. But instead of *Conops* being parasitic upon *Eumenes* or *Trypoxylon*, or *Pelecinus*, all known *Conops* are parasitic upon the very dissimilar family of bees and especially humblebees, with the exception of two species, which are parasitic upon fossorial wasps, but not upon *Trypoxylon* or *Eumenes*, but upon *Pompilus* and *Odynerus*, to which they bear but small resemblance. (West. *Intr.* II. p. 560–1. Saunders *Trans. Ent. Soc. London*, n. s. Vol. 4, Pl. 28. St. Farg. *Hymen.* I. p. 456.) Again, it was long ago remarked that the Dipterous genus *Systropus* strongly resembles the Hymenopterous genus *Ammophila*, and so it certainly does. (West. *Intr.* II. p. 543.) But *Systropus macer* Lw., or as I wrongly named it *Conops analis?* Fabr., instead of being parasitic on *Ammophila*, as the common theory would lead us to suppose, is parasitic, as I have shown, on an insect that is altogether unlike a Systropus, and does not even belong to the Order Hymenoptera but to the Lepidopterous Heterocera. (See my Paper *Proc. B. S. N. H.*, Feb. 1864, p. 300.)

When I here speak of parasitic insects, I distinctly exclude those which are sometimes called parasites, but more correctly Inquilines or Guest-flies, such as the inquilinous Cynipidæ, certain inquilinous Cecidomyia of which I shall have more to say on a future occasion, the Apide genus Cœlioxys and the Bombide genus Apathus. (See my Paper on Cynipidæ, *Proc. Ent. Soc. Philad.* II. p. 478.) Here resemblance of form and color is accompanied by a close systematic affinity, which is scarcely ever the case with the true Parasites. Hence I conceive it to be perfectly possible that the *Bombus* may mistake the *Apathus* for an individual of its own species, but that it can so mistake

the Dipterous *Volucella*, I do not believe.* It is a remarkable fact that the Coleopterous *Rhipiphorus paradoxus* (Europe) which is parasitic in the nests of *Vespa vulgaris*, and the Lepidopterous *Galleria cereana* which inhabits the nests of another social insect, the common honey-bee, are as unlike the insects among which they live as it is possible to conceive.

4. The food of Diptera and of Coleoptera is said to be "vegetable, articulate-animal or vertebrate-animal," (pp. 17, 24.) In the case of a

*As illustrative of the possibility of *Bombus* mistaking *Apathus* for its own species, I may quote here a remarkable fact, which I witnessed the very day (Sept. 20) that I received the proof sheets of the above.—Noticing what I supposed to be a ♀ *Apathus elatus* Fabr. surmounted by a ♂ on the flower of a thistle, but not in actual copulation, and having long sought for the ♀ of that species in vain, though the ♂ ♂ occur here by hundred, I wrapt them both up in my handkerchief and took them straight home. On turning them loose into a glass vessel, the ♂ in the course of a few minutes again surmounted the ♀, but all his amorous caresses could not induce her to withdraw the tip of her anus from under her abdomen. In about five or ten minutes, he desisted and released his hold; when on killing them I was astonished, and disappointed withal, to find that the supposed ♀ *Apathus elatus* was nothing but a ♀ *Bombus fervidus* Fab., so fresh and bright that it evidently belonged to the newly-hatched autumnal brood. I could scarcely believe my own eyes when I saw the pollen-basket, the tooth on the first tarsal joint of the hind leg, the anus directed backwards in death, and the broad, obcuneiform, striated mandibles of the ♀, and the convex hind tibiæ, covered with short, dense, stubbly bristles, and devoid of any polished spot or long lateral fringe, in the ♂. Although the caresses of the incestuous lover were firmly repelled, yet there was evidently no anger or hostility on the part of the lady; for she made no attempt either to bite or to sting him, though she had abundant opportunity to do either. It is remarkable that, so far as known at present, this species of *Apathus* does not occur in the nests of *B. fervidus*, which it so closely resembles, but in the nests of a very dissimilar species, *B. pensylvanicus* DeGeer. (Cresson *Proc. Ent. Soc. Phil.* II. p. 164.)—I may add here, that as I have recently captured 17 ♂ ♂ of *Apathus citrinus* Smith in company with 4 ♀ ♀ of *A. laboriosus* Fabr., and as the ♀ of the former and the ♂ of the latter species appear to be unknown, I incline to believe them to be the sexes of one and the same species. In that case the ♂ having the dorsal base of his abdomen *yellow*, and the ♀ *black*, finds a partial parallel in ♂ ♀ *B. pensylvanicus*. In the genus *Apathus*, as in many others, (*Proc. Ent. Soc. Phil.* II. p. 223,) the ♂ ♂ seem to preponderate greatly over the ♀ ♀; so that it is very improbable, that I should find as many as four ♀ ♀ of *A. laboriosus* and not a single ♂ in company with them, which must have been the case if *laboriosus* and *citrinus* are distinct species.

larva belonging to the Dipterous genus Tabanus, I have shown that the food is molluscous-animal, for it feeds upon aquatic snails. (*Proc. B. S. N. H.*, Feb. 1864, p. 302.) In the case of the European glow-worms (Coleoptera) it is also molluscous-animal, for they feed upon land-snails. (Westw. *Intr.* I. p. 250.) Again, it is said of Hymenoptera that "their food is either vegetable or articulate-animal, not vertebrate-animal; the animal food being thus the same in kind with the material to be made of it, just as among Mammals the highest of carnivorous species live on the flesh of Mammals, and only the lower on fish and insects" (p. 16). But it is well known that in Europe the common wasp, *Vespa vulgaris* Lin., habitually carries off butchers' meat, (Westw. *Intr.* II. p. 246,) and consequently the food of this genus, which is generally allowed to be one of the highest Hymenoptera, is partly vertebrate-animal.

5. There is a little confusion in the text as to the "prematurative" or "permaturative" character of the Homopters and the Trichopters. The Table (p. 15) correctly gives the first as "prematurative" and the second as "permaturative"; but afterwards (p. 18) it is said of the Amplipens that "those of the highest division are permaturative and the rest are prematurative", whence it results that the Trichopters are prematurative, which they certainly are not. Again, it is said of the Attenuates (p. 20) that "the mouth, unlike that of the Lepidopters and Homopters, but like that of most of their larves, is not suctorial but mandibulate," whence it results that the Homopters are in the larva state mandibulate (!) and consequently must be prematurative, as the imago is correctly said to be haustellate.

6. The Perlideans are said to be like the Phryganeans in "living in a sheath" in the larva state (p. 22). This erroneous statement originated with Reaumur, and was copied by a host of closet-naturalists, but finally explained and corrected by Westwood. (*Intr.* II. pp. 22–3.) I can add my testimony to Westwood's, having seen thousands of the larvæ of many different species of Perlina, crawling about naked on the under surface of submerged stones.

7. The Saltators are said to show that they are the typical Orthopters "by the absence of any close likeness to other groups," (p. 25.) But Westwood mentions several species belonging to the Cricket family, "which singularly represent coleopterous insects." (*Intr.* I. p. 459.)

8. In this system, as we have seen, the Lepidopters are classified as "perterrestrial" and the Hemipters (Heteroptera) as "mostly terrestrial." But the larvæ of some Lepidoptera are aquatic with aquatic respiration, (see Westw. *Intr.* II. p. 400 and Harris *Inj. Ins.* p. 476); and those Heteroptera which inhabit the water (Nepidæ and Notonectidæ) breathe through spiracles in all their states and never through branchiæ. They are not therefore semiaquatic or aquatic, in the sense given to these terms by Prof. Dana. Consequently the Lepidopters should have been classified as "perterrestrial or semiaquatic," and the Hemipters as "perterrestrial."

9. The Trichopterous larvæ (Phryganeina) are said to "spin silk-like fibres from the extremity of the abdomen, or the lip, or both" (p. 30). So far as regards their ever spinning from the extremity of the abdomen, I doubt this statement very much. It is contrary to analogy that larvæ belonging to the same family of insects should spin, sometimes from the mouth like other larvæ, and sometimes from the anus like spiders. Westwood says that "they spin from the mouth in the same manner as caterpillars." (*Intr.* II. p. 62.) I know from personal observation that the larvæ of the Ichneumonide genus *Brachygaster* spin from the mouth, having seen a group of them actually engaged in spinning their singular symmetrical masses of cocoons. The only true insect known to spin from the anus, so far as I recolleet, is not a larva but a Coleopterous imago—the European *Hydrophilus piceus*, which strongly resembles our *H. triangularis* Say, but is several sizes larger. It would be interesting to know whether the American species has the same remarkable habit. (See Westw. *Intr.* I. p. 124.)

Rock Island, Illinois, July 21, 1864.